

THE ESTUARY BISON POUND SITE IN SOUTHWESTERN SASKATCHEWAN

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by

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ABSTRACT

The Estuary Bison Pound site is located near the head of a large coulee on the south bank of the South Saskatchewan River, just below its confluence with the Red Deer River. Excavations in 1971 and 1972 revealed two major occupation levels. The upper, Level I, is likely a processing or habitation component, characterized by small stone tools, completely butchered bone, hearths and a large refuse pit. The lower, Level II, includes a portion of a bison pound and a butchering area, used at least three times in rapid succession. While Level I is represented by an assemblage that conforms exactly to the Old Woman's phase, Level II has aspects of both that and Avonlea phase material. Radio-carbon dates suggest that there is only 100 to 200 years distance between these two occupations. Together, they present strong evidence to suggest that the Old Women's phase developed from Avonlea.

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I

INTRODUCTION

PURPOSE

Excavations at the Estuary Bison trap were carried out to serve two basic purposes, the urgent salvage of an important heritage resource, and the provision of a temporal dimension to the local prehistoric sequence. The salvage project was designed to retrieve data from this site that was undergoing a continuing process of destruction by natural and human agencies. As an integral part of the Southwestern Saskatchewan Archaeological Project, the site was thought to be an important link in the development of a prehistoric outline for this region (Millar, et al, 1972: 3-5).

As excavation and analysis proceeded, it became evident that these aims were even more valid than had first appeared. Two characteristics at the site and components gave this still greater priority. It was found that what seemed to be ten to twelve components in the site actually proved to be but two major, excavatable components. This allowed for a far more extensive area to be exposed. Subsequently it was discovered that the two components had some significant typological differences even though they were very close in time. The fundamental difference was that the lower level had indicated a mixing of Avonlea and Prairie Side-notched point styles while the upper had only the latter. During the analysis, the supplemental problems which arose were reluctantly set aside for future study and the original purposes were refined and clarified.

The original broad purposes were therefore refined and restricted to:



1. presenting a solid data base in the form of a complete site report,
2. determining the nature of occupation levels and to fix them into a cultural context in time and space,
3. explaining the differences between the components through their relationships in the Northwestern Plains sequence.

The excavation program successfully salvaged the essential information from the site. In addition, the site analysis and comparative study contributed to the knowledge of the Late Prehistoric period in Southwestern Saskatchewan by meeting the stated objectives of this study.

In this dissertation, the basic text and appendices provide the raw data on the environment, site features and artifacts. Sections 10 and 11 summarize and interpret that data to delineate the unique character of each component. Finally, the site is placed in the context of regional and temporal prehistory.

#### HISTORY OF THE PROJECT

The Estuary Bison trap (Ef0k-16) is located 14.1 km west and 3.5 km north of the intersection of Highways 21 and 32. The site is situated near the head of a large coulee in the southwest quarter of Section 4, Range 27, Township 23, west of the third meridian (30° 55'N - 109° 44'W). It crosscuts fields owned by E. L. Schneider to the north and by A. Ausmus to the south (Fig. 1).

The trap is in a steep sided coulee where the overburden has never been broken, though there was an unsuccessful attempt to farm the field above the coulee at one time. The site was first exposed during the early 1960's when a flash flood left a deep gash along the bottom of the coulee, exposing the west side of the site. Charles Nagel, a

responsible amateur archaeologist, discovered the site while hunting in the coulees. Later, he and his brother, Norman, collected the exposed artifacts and informed the Saskatchewan Provincial Museum of their discovery. When, after several years, the Museum was still unable to examine the site, these amateurs dug out about 16 m<sup>2</sup>, retrieving over 200 projectile points and vast quantities of bone.

By 1970 another 80 m<sup>2</sup> had been destroyed by unknown collectors and by the now highly active erosion. In the fall of that year, the site was shown to Dr. J. F. V. Millar and H. Epp who were actively engaged in a survey of archaeological sites for the Southwestern Saskatchewan Archaeological Project. Their examination led to the conviction that the site was worthy of professional excavation and in need of prompt attention.

In the spring of 1971, I successfully applied to three different sources for funds to undertake this research. The National Museum of Man supplied the field expenses, Opportunities for Youth paid the salaries of five crew members and the Student Temporary Employment Program provided salary for a sixth person. Together, these agencies supported a full, three-month excavation.

At the end of the first year, several problems relating to the site were still unsatisfactorily solved so a second application was submitted for a short field season. The Canada Council provided funds for salaries and field expenses for five field workers for the month of June, 1972.

By the end of this time, most of the problems recognized by the excavators had either been solved or at least isolated for further

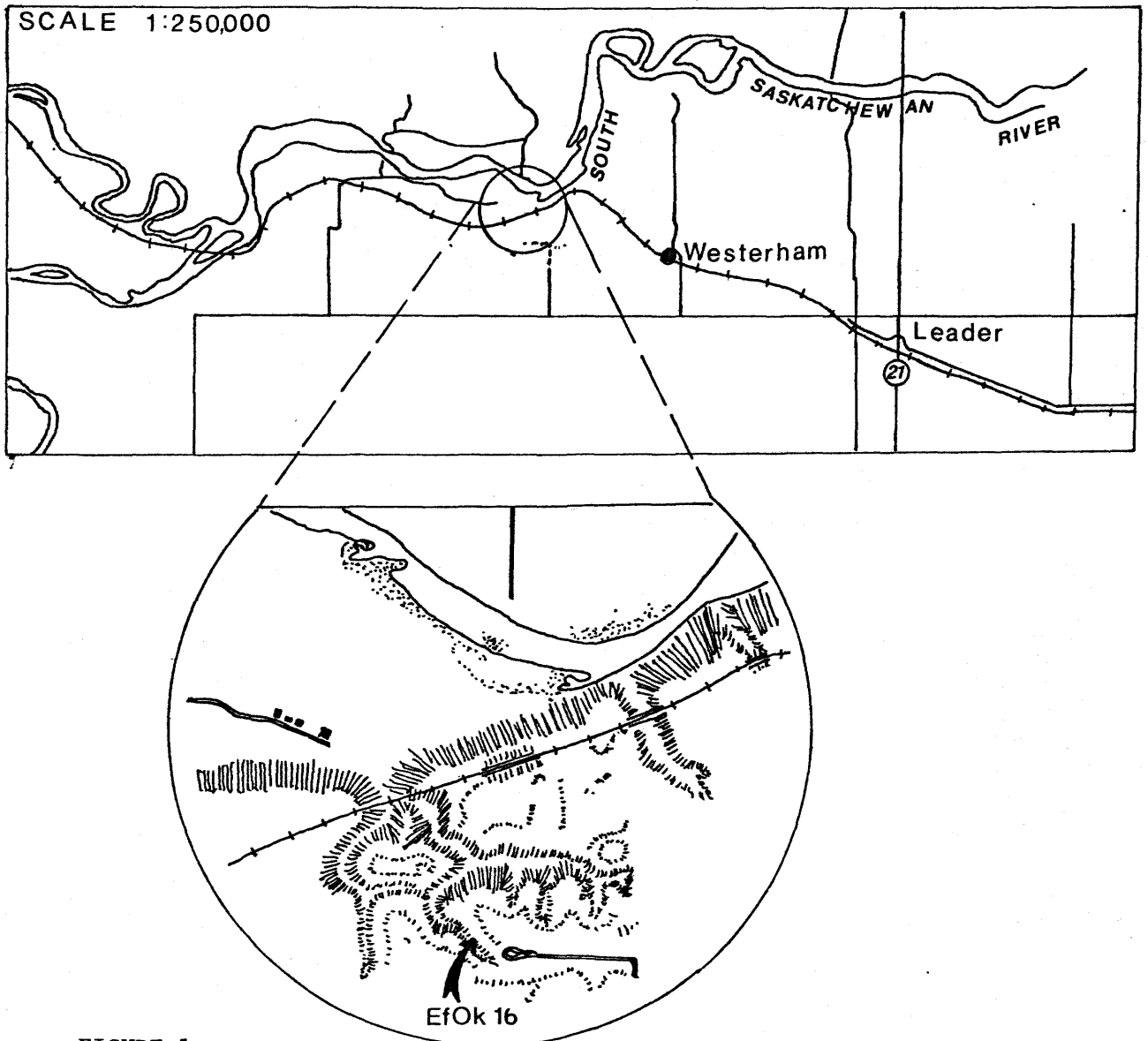
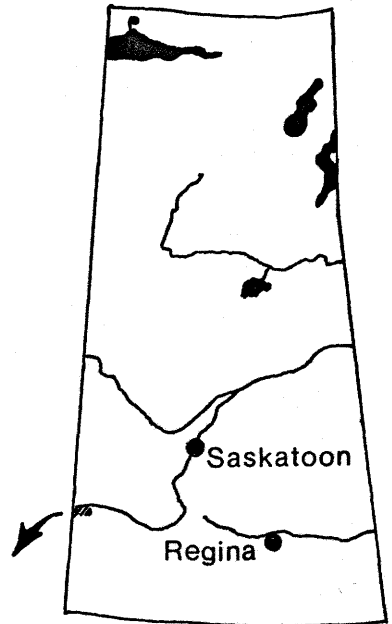


FIGURE 1

SITE LOCATION MAP

examination and analysis. A suitable sample of artifacts had been accumulated and a cross-section of the site excavated. However, over half the site remained undisturbed and may become subject to the ravages of collectors.

## THEORETICAL CONSIDERATIONS

### BACKGROUND

During the past decade or more, work on prehistoric communal hunting patterns has been one of the most extensive research areas of Northwestern Plains archaeology. To summarize all the available historic, ethnographic and prehistoric data would be redundant at best. Therefore, to simplify the background presentation and to establish certain research parameters, attention will be given in this section to simple explanations of basic points of reference to be used throughout the text.

This paper is broadly segmented into five parts: the background, presentation of data, site interpretation, comparisons and conclusions. The first of these, the background, includes environmental, ethnographic, and prehistoric contexts. In the environmental context a comprehensive overview of the natural environment is presented for a defined geographic region. Later, the local environment of the site is described. This provides the reader with a conceptual understanding of how the environmental limitations of a larger region can be measured in a local context. Conversely, it demonstrates how observable environmental characteristics are manifest throughout a larger area. This indicates the degree of uniqueness of a single site. It also provides an attempt to establish some time depth to the regional environment.

The ethnographic-historic background is considered as peripheral to the purpose of this paper. The main value of any ethnographic description is merely to provide suitable terminology and reference material. Extensive ethnographies are available for virtually all the tribes in the

Northwestern Plains at the time of contact. These include the Assiniboine (Lowie 1910, Long 1961), Blackfoot (Wissler 1910, 1911, Ewers 1955, 1958), Cheyenne (Grinnell 1924, Hoebel 1960), Cree (Mandelbaum 1940, Kane 1859), Crow (Lowie 1935), Gros Ventre (Lowie 1909, Steward 1938). Primary accounts of early contact are numerous and have been reviewed for the immediate area (Adams 1976). Since most accounts occur after eastern population pressures had forced massive tribal migrations, attempts to outline some of these movements have been undertaken by many authors including Hewes (1948), Wood (1955), Oliver (1962), Hlady (1964) and Ray (1975). There are also several detailed analyses of various socio-cultural aspects of traditional plains culture throughout the anthropological literature.

One particular aspect of Northwestern Plains culture, communal hunting, is especially important to this paper. Though originally thought to be restricted to the late summer when the bands gathered, recent archaeological evidence suggests that this form of hunting was conducted throughout the year (Arthur 1974, Walker 1974).

There were three primary methods of co-operative bison hunting on the Northwestern Plains, the most popular of which was the pound method. This was the preferred method of the Plains Cree, Assiniboine, Blackfoot and Gros Ventre (Hornaday 1889:478) and was also used by the Cheyenne (Grinnell 1923:55) and by the Shoshoni for antelope (Lowie 1909). It was also the method most often witnessed by whites. Hind, Harmon, Franklin, Back, Hood, Kane, both Henrys and Maximillian all presented eyewitness descriptions in their journals.

Ethnographic literature described the pound itself as a circular enclosure, between 20 and 100 m in diameter, enclosing about two acres.

In the centre stood a lone tree to which offerings were made. The enclosure itself invariably consisted of a lattice of trees and logs interwoven with brush to create a solid wall appearance, about 2 m high. To prevent the buffalo from leaving through the entrance, a drop in land was needed. If possible this was accomplished by using a small cutbank or ridge which would also serve to hide the pound from the sight of the animals. If this was not possible, a ramp was constructed of wood or snow and the pound was hidden in a grove of trees, the centre of which was hollowed out for the enclosure.

Extending from this entrance in the direction of the open prairie was a double row of brush, logs, rocks, or other materials that angled away to form a funnel mouth. This funnel, called the chute, was solid for 50 to 300 m, then continued out into the prairie for another km or two as long rows of evenly spaced piles, each less than one metre high. When no bluff was available the chute may have had a curve in it near the pound itself so that the pound would not be seen by the stampeded buffalo.

On a chosen day, the hunters scoured the area until a herd was sighted and then they lured or herded it back to the mouth of the chute. Once in position, the herd was stampeded along the chute by the hunters and by fellow band members of both sexes who had been hiding behind the chute markers. These people would rise as the animals passed by them, shouting and waving blankets to prevent the beasts from veering to either side. Once inside the pound the animals were dispatched by bow and arrow as they milled around. They were then butchered and the meat divided amongst the band members by some ritualized system.

The second type of communal hunting method was the drive. In essence, there is little difference between the drive and the pound except that

the drive users took advantage of more rugged terrain to send the bison over a cliff which might be high enough to kill the animals without the use of a bow. The resemblances between the two kill types became even more obvious when a drive cliff had insufficient height to kill the animals for then the Indians would construct a whole or partial pound at the base of the cliff. This method was the favorite of the Blood, Piegan, Gros Ventre and perhaps the Kutenai and Sarsi (Wissler 1910: 49-50). In fact, Wissler's informants among the Piegan went so far as to say that they never used the Cree type of pound.

The buffalo drive consisted of five parts according to Conner (1962a: 1-2). The first part was the gathering basin on which the animals collected. This could have been several kilometres from the jump. The second part consisted of the drive lanes, which were generally formed of rock piles similar in length and shape to the pound chutes. The third part was the cliff itself which could be from 3 to 90 metres in height. The fourth part was the area at the base of the slope where the buffalo landed and were butchered, and the fifth part comprised the associated camp area of the drive users.

Up to this point there was no significant difference between the pound and the drive except for the height of the fall. This single feature, however, dictated most other changes. At the base of the cliff there may or may not have been an enclosure, depending entirely on whether or not the animals would be killed on impact. If the fall was not enough, then a one-half to three-quarters circle was constructed to force the animals to mill around until slaughtered. The enclosure was generally constructed in a manner almost identical to that of the pound. A good drive site was valuable and was therefore well constructed, so that it could be used over an extended time period.



The third and last communal hunting method of the Northern Plains was the surround method used extensively by the Mandans, Cheyenne, Arapaho, Sioux, Pawnee, Omaha, etc. (Hornaday 1889:481). This method was generally a favorite of the widely wandering bands of the south who had little opportunity to use the other two methods. The advantage of the surround was that it could be used at any time in any place where there was sufficient manpower. Unfortunately, a lack of primary source information prevents a highly detailed picture of this particular form of hunting but some insights can be gained from Roe (1970:630-6), Grinnell (1923:54-7) and Hornaday (1889:481-2).

One of the real problems of a description of this method is to get some kind of information that predates the use of the horse. Grinnell gave one of the few accounts of a surround accomplished on foot. In it he stated that once a herd was sighted, the tribesmen (Cheyenne) formed a circle around the buffalo. First they filled in the leeward side and then the crosswind sides. When the windward side was filled the bison would scent the men and run in the opposite direction. Men stationed there would then shout and wave blankets causing them to veer. This would be kept up until the animals were circling. At the same time the men would be closing the circle and periodically one would rush in to dispatch an animal. This would continue until either the animals broke the circle (Assiniboin account, Roe 1970:632) or until every last animal was dead (Mandan account, Roe 1970:632).

With the advent of horses and the new 'Plains Culture' the surround method increased in popularity. Large bands of horsemen would ride out, find a herd and surround it. Then by running their horses in ever de-

creasing circles they could set the herd into its clockwise pattern. Then whenever an animal tried to break the circle it would be shot until the whole herd was dispatched. An example of this type of hunting and its wastefulness can be seen in this passage paraphrased from Catlin:

...whereupon some 500 or more Sioux on horseback crossed and attacked them (a herd of buffalo), returning to the post at sunset with 1400 fresh buffalo tongues. (Roe 1970:631).

One last aspect of the surround method that should be mentioned is the use of fire. As the animals always ran from a fire, it was a method of herd control among several of the eastern and northern groups to light small fires so that the bison could smell the smoke. Further, there are references to large prairie fires being lit to either prevent buffalo from leaving an area or to entice them into one. However, evidence of this aspect is mostly hearsay and informants generally tended to deny any such actions on the part of their people. This would lead one to believe that this was purely a desperation measure, frowned upon unless entirely necessary.

To summarize the terminology, a "bison drive" is a generalized term for a communal hunt. The three types of drives include the "pound", "jump" and "surround" methods. The first two of these methods have designated parts that include the gathering basin, drive lanes (chutes), entrance (a cliff or disguised opening), kill area and butchering area.

In the past few years, archaeologists have become concerned with the ethnographic and historic accounts of bison behaviour, communal hunting practices and bison processing or utilization. Perhaps the most sophisticated collection of data has been presented by Arthur (1974) but useful summaries have also been presented by Frison (1970a), Wheat (1972)

and Kehoe (1973). These people have summarized in depth, bison behavior, hunting practices, religious connotations, seasonality, utilization of the bison, butchering practices, tools used and so on.

The archaeological background utilized in the context of this paper is presented in various stages throughout the text. Direct comparisons of artifacts and features with those of other sites are presented with the artifact data. Later, a generalized comparison of Northwestern Plains sites is presented in a separate chapter which acts as a prelude to a synthesis of the regional prehistoric sequence.

#### DATA PRESENTATION

Two restraints place certain limitations on the extent to which the data can be put to use. The first is layer mixing which is discussed at several points throughout the paper. The second is the close similarity between certain aspects of the cultural levels combined with the great diversity of other aspects.

To handle the first problem, several pits were isolated as probably mixed. The planviews, profiles and other records were carefully scanned. In most cases, verifiable information was assigned to its proper cultural component and unverifiable information was treated separately. Though this process worked very well for the features and lithic materials, it was not as suitable for faunal analysis. Therefore a different approach was taken for the bison remains.

From the beginning, it was obvious that the mixing problem had resulted from overextending the depth of Level 1 in excavation units 1-3, 6 and 11-15. In an attempt to rectify this problem, three tests were run to determine the percentage of bone that could actually be attributed to each level. First, bone counts were conducted on the disputed

and adjacent pits. It was found that the questionable pits had up to five times the number of bones in Level II as opposed to Level I (i.e. pit 15 had 273 to 54). On the other hand, adjacent pits to the north had no more than 50 fragments per pit in Level I while it had almost disappeared to the east.

Second, it was found that some of the bones located in large Level I bone groups articulated to specimens from the lower level. Finally, between 70% and 90% of the disputed bones had distinctive charcoal and burn marks that were diagnostic of Level II faunal remains.

It was eventually determined that little more than 10-20% of the disputed bone belonged to Level I. Furthermore, the Level I bone in adjacent pits was mostly unidentified and unanalyzed fragments. Therefore, to save speculation, all the identifiable disputed bone was arbitrarily assigned to Level II.

Further theoretical assumptions had to be made before the analysis could be completed. Since not all aspects of butchering procedures were represented on the bone and since the site was not totally excavated, these assumptions became necessary to the analysis. As Frison (1970a:9) suggested:

It is assumed, however, that the repeated occurrence of similar tool marks in the same locations on bones reflect stylized processes, and the basis for the interpretation of a culturally accepted way of handling buffalo carcasses under circumstances that required maximization of effort to prevent loss of meat through spoilage.

This assumption was then carried to the distribution of bones. The excessive abundance or absence of a particular bone or portion of bone was believed to be just as indicative of specialized functions and processes.

A further assumption by Frison (1970a:9-10) was that the tools utilized in the meat preparation were represented in the artifact inventory. This seemed especially valid for the bone tools which were not likely to have a long lifespan, particularly if used under concerted effort. Stone tools discarded at the site were also considered to be functional but were not believed to be a complete inventory because certain tools were likely removed to other sites or unexcavated portions of this site for specialized purposes. This assumption becomes quite valuable when a synthesis of the material remains is attempted in later sections.

The problem of possible confusion that could have resulted from the similarity of the two levels was averted by describing each level separately from the other. By presenting a total picture of each component and cross-referencing only to simplify descriptions, it became easier to treat them as unique activity areas. It also facilitated intrasite comparisons. Ambiguous material was handled in an extra chapter.

Minor theoretical or technical problems relating to typology and description were considered to be too specific for general treatment. Therefore, these are included in the introductions to the specific cases. Finally, the comparisons and conclusions are straightforward so little is said of any theoretical approach. All archaeological terminology is taken from Willey and Phillips (1968) or is referenced.

## BIOPHYSICAL ENVIRONMENT

### DEFINITION OF STUDY AREA

The Great Plains have been divided and sub-divided countless times but usually with the same conclusion: though they may be divided for specific purposes, the plains should be treated as a whole. Conner (in Caldwell et al. 1968:13) says that all borders are somewhat arbitrary and should be "a basis of discussion and not definition".

For the purposes of this paper, the geographical limits of the "Great Plains" include the base of the Rocky Mountains on the west, and the southern edge of the parklands on the north. The east boundary includes the Red River valley and the western edge of Iowa, then cuts southeast to the junction of the Mississippi and Missouri Rivers and then southwest to include the western half of Texas. The southern boundary is the Rio Grande River.

Anthropologists, archaeologists and historians have all found it quite profitable to divide the Great Plains into north, central and south regions for purposes of discussion. The research for this thesis concentrates in that region usually called the "Northern Great Plains". The Northern Great Plains have been defined as that area bounded by the southern edge of the parklands on the north; the Rocky Mountains on the west; the eastern edge of the Red River drainage on the east; and the South Dakota - Nebraska border on the south (Strong 1940:55, Wedel 1961:22, Willey 1966:311 and Caldwell et al. 1968:13).

The Great Plains, in turn, have been sub-divided in several ways from east to west. Wedel (1961:23) partitioned it into Northeastern Periphery, Middle Missouri and Northwestern Plains, while Strong (1940:55) and Conner (Caldwell et al. 1968:13) broke it into eastern

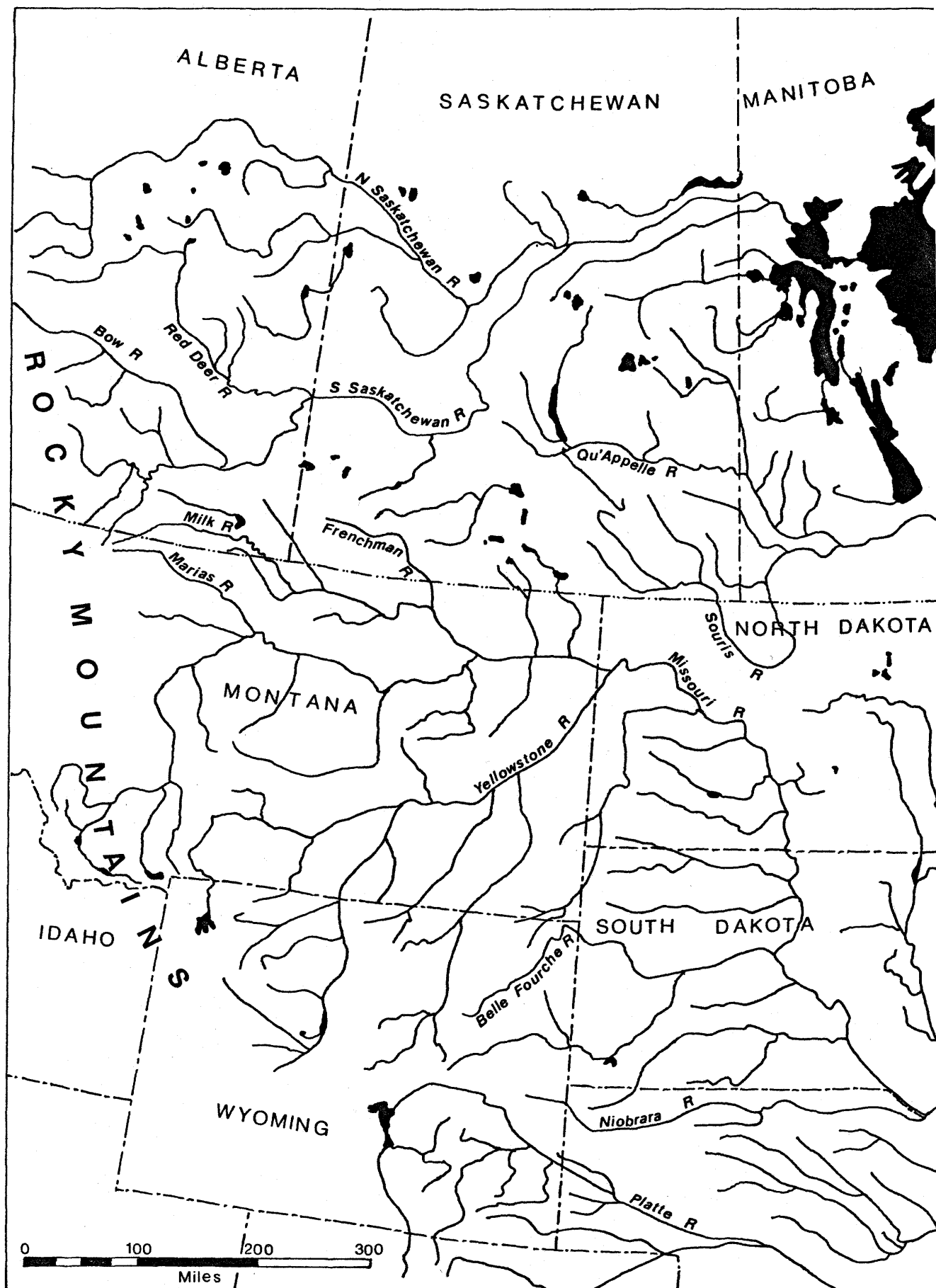


FIGURE 2

THE NORTHWESTERN PLAINS

and western halves. This thesis concentrates on the Northwestern Plains, an area defined as extending from the edge of the parklands to the Niobrara River and from the Rocky Mountains east to the eastern edge of the Missouri slope in the south and angling eastward to the western shores of glacial Lake Agassiz (Fig. 2).

#### PALEOENVIRONMENT

One problem that constantly appears whenever an environmental reconstruction is being proposed is the degree of similarity between that reconstruction and the modern environmental setting. For the immediate purpose of this dissertation, that setting occurred around A.D. 900 <sup>±</sup> 500. The A.D. 900 date was suggested by dating techniques described below while the degree of error has been left purposefully large to accommodate any error and to provide a wide scope for comparison with other sites.

The period between A.D. 400 and A.D. 1400 included three climatic periods on the Northwestern Plain. The Scandic Period (400 - 900 A.D.) represented a period of summer dominant storms with minor fluctuations in precipitation patterns. It was marked by lower precipitation values, higher mean temperatures and erosion in stream valleys. The Neo-Atlantic (900 - 1200 A.D.) brought the climate to essentially modern status but still with lower precipitation values and higher temperatures. During this period the dry westerly winds decreased and the parklands shifted southward and westward into the prairies. The Pacific (1200 - 1500 A.D.) was a period of stability and soil formation during which the boreal forest retreated, the westerly winds increased and the area became somewhat more arid. This was a major erosional period unlike the other two. The end of this period introduced the modern stable soil forming period



that continues to this date (Reeves 1969:17-18, Reeves 1970a:155).

From the above, one can assume that for the most part, the present, or at least the historical environment can be equated fairly closely with most environmental conditions over the past 1,500 years. The most significant differences would be the degree of aridity, the wind changes and the southward and westward extent of the boreal forest and parklands.

#### PHYSIOGRAPHY

Though constantly characterized by observers as a flat monotonous expanse, the Northwestern Plains have considerable diversity in their topographic nature. Wedel (1961:27) characterizes the Northwestern Plains as a series of terraced plains with wide valleys, irregularly spaced and often so far apart that internal drainage develops. The Missouri Plateau is broken by large tracts of isolated mountain masses of diverse origins spread over the Missouri Plateau (Little Rocky Mountains, Big Sunny, Black Hills, Bearpaw Mountains, Cypress Hills, Big Horn Mountains, Sweetgrass Hills, etc.). There are also large stretches of badlands associated with river valleys (Missouri, Yellowstone, Little Missouri, White, Frenchman, Milk, etc.), which are offset by ridges, hills, cliffs, and breaks. Large sand tracts (Great Sand Hills, Platte River Sand Hills) present entirely different micro-environments.

In general the region is characterized by three drainage systems: the Saskatchewan, the Assiniboine and the Missouri which drain into the Arctic, Atlantic and Gulf of Mexico respectively. From east to west the natural regions include the Manitoba escarpment, the Missouri Coteau and the Foothills in the north and the Missouri and High Plains in the south.

Much of the north and eastern parts of the area are characterized or

modified by glacial till or glacial features. Besides moraines, drumlins, erratics, drainage channels and knob and kettle topography, many important rivers are former glacial spillways and large, flat post-glacial lakes are now important agricultural basins. It has been suggested that in pre-agricultural days much of the area was poorly drained and characterized by innumerable lakes and marshy areas (Wedel 1961). Indications of this phenomenon are still plentiful throughout the region around the site.

However, to inhabitants of the area it must be assumed that one of the most important features is the major watercourses. Throughout the Northwestern Plains, nearly all the rivers rise in the mountains and flow roughly to the east. Many are entrenched in flat floored valleys over a hundred metres below the general surface level and vary in width from one to several kilometres. The floodplains of these rivers are well wooded in many places with cliff face walls broken by a series of well marked terraces that provide sheltered, convenient, flood-free habitation for a small group of natives.

Most agricultural soils in the north are developed on glacial till while south of the glaciated zones, the deposits overlay sandstone, limestone, shale, lignite and conglomerates. Brown or chestnut soils occupy most of the region, the former ranging closer to the mountains and in the drier areas. Sorting by wind and water provides a wide range of textures from heavy clays in former lacustrine deposits to sand dunes. Locally, these soils, for the most part, are chernozemic and characteristically have a dark brown A horizon, a lighter B horizon with a

moderate to strong grade and a light weak grade, carbonate filled C horizon.

#### CLIMATE

The Northwestern Plains, like most of the rest of the plains, are characterized by certain climatological features. The amount of precipitation is low and decreases from east to west. It is especially limited in winter and the winter snows leave even less moisture. Furthermore, the moisture is extremely irregular in both long and short term senses. Pronounced daily and seasonal temperature changes, low relative humidity, high rate of evaporation, frequent drought, abundant sunshine and persistent winds of high velocity are also regular features of the area.

The most significant factor, however, has got to be the extent of variability possible in the plains, for a few years of drought or particularly long or cold winters will completely alter the whole ecological system.

West of the 50 cm annual rainfall mark, moisture variation is considerable and in large hilly areas completely different types of vegetation cover can be found. The annual distribution of moisture is as important as the actual amount. In most cases the growing season receives 65% to 75% of the precipitation but a variation of 10% to 20% is not impossible and can be disastrous, especially to horticulturalists. These variations are especially important west of the 97th and 98th meridians where conditions are marginal at best.

Weather conditions are further complicated by certain features of the plains. Summer moisture comes mainly in the form of thunderstorms of great violence and short duration. These storms may drop masses of

water most of which is runoff. Further, these storms are usually local and erratic. The wide expanses of open land, combined with great temperature changes, give rise to strong winds that have a free sweep of the plains. In the winter they blow from the northwest and with the single exception of the chinook wind, they are very cold. In the summer they tend to blow from the west and south and strong winds tend to bring drought conditions and temperatures that can easily rise to 38 - 43° C (Wedel 1961:30-33).

Drought is a result of three factors. First, the average daily maximum temperatures are up to 6° C higher than normal, and the ground temperature rises to 60 - 66° C. Second, evaporation is more rapid and more complete, up to 35 percent greater than a normal year. Finally, the wind is higher, hotter and more constant making the area susceptible to dust storms and blowouts (Coupland 1959:285-6).

#### FLORA

The natural vegetation of the Great Plains consists principally of grasses, which vary from east to west. On the west, from the South Saskatchewan valley across Montana and into western North Dakota are the short grasses. These plains consist mainly of varying associations of buffalo grass, grama grass, June grass and spear-grass. They are low-growing, shallow-rooted and sod-forming and are capable of drying without losing their nutritional value. On the east are the tall bunch grasses like bluestem and wheat grass. These are more luxuriant and characteristic of the moister soils. There is also a broad band from roughly the 98th to 100th meridian where both grasses are found and where the predominant species depend on the elevation, and the amount of moisture and evaporation.

Trees are found only in specific areas. River bottoms, large hilly areas, and scattered copses to the north are the primary treed areas though high bushes and scrub can be found in rough country such as dune or badland areas. These badland areas are always more sparse of grasses and their places are usually taken by sage dominated scrub and/or cactus.

There are a wide variety of flowering trees, shrubs and ground plants, many of which provided food, medicine or tools for the native populations (Wedel 1961:34-38).

It is important to note the effects of drought upon the vegetation of the region. Forage yield is closely related to the ratio of precipitation to evaporation. The immediate response to drought is curtailment of height rather than a decrease in density. (In North Dakota, grass height in 1934 was one-third that of 1933, slightly higher in 1935, one-fifth of the 1933 height in 1936 and had recovered by 1949.) Shorter growth reduces shade which prevents blossoming and seed production. In addition, drought is usually accompanied by grasshopper infestations which in 1936 removed 30 to 40 percent of the forage in North Dakota. Finally, under drought conditions the roots shorten to compete for surface moisture (Coupland 1959:286-7).

#### FAUNA

Though the animals of the Great Plains are not distinct, unique animal forms, they do have certain characteristics that have been outlined by animal ecologists. Most species are tolerant of dry air, relatively independent of water or regular watering habits and are protected from or resistant to high winds or sharp temperature changes. Burrowing and hibernation are common behaviour. They are usually quiet and dependent on sight rather than smell or sound. Other common

characteristics include swift running and the limitation of daily activities to early morning, evening and night time (Malin 1947:20-24).

The basic mammals of the steppe are ungulates (bison, mule deer and antelope), rodents and canids. Of these the rodents are the most numerous in both species and numbers, consuming 75 percent of all available food (Malin 1947:20). Since animal forms are as dependent on the physiography as the flora, the river valleys and the hills are generally filled with a full complement of woodland type mammals.

Aviforms are varied and relatively dense. Marshlands and riverbanks are highly populated by ducks and shorebirds. Songbirds and upland game birds are prolific on open prairie. The raptors have always provided one of the most effective limiters to rodent growth. During spring and autumn, the bird population is augmented by the great flocks (especially of ducks and geese) that pass through on their voyages to and from the Arctic.

Reptilian forms are more abundant than in other areas of the same latitude, but the majority are dryland varieties - snakes, desert lizards, land turtles and horned toads. Rattlesnakes form one of the few dangerous animals in the northern prairies.

#### BISON

The extreme value of the bison as a resource requires a special treatment of this mammal. However, since the animal has long since disappeared from its wild state on the prairies, all the sources are essentially secondary. Even the early bison biographers, Allen (1877) and Hornaday (1889) gave distorted accounts. More recent sources (Roe 1970, Arthur 1974) rely entirely upon the early naturalists and the random remarks of early explorers, traders and hunters.

Beginning in August or September, the rutting season, the bison began congregating in much larger herds. Seton (in Roe 1970:492) suggested these herds gathered from a radius of 100 to 400 miles (160 to 640 km) from the nucleus. During this time the bulls were in their prime and were preoccupied with mating and fighting.

When the mating season was over, the herd split up again into smaller groups of 20 to 200 individuals, apparently with males and females separated. Each group began an incessant forage for grass and water. Feeding on the dry but highly nutritious grasses of the plains, the cows reached their peak condition in late autumn.

As winter approached, the herds continued to decrease in size and gravitate towards shelter or areas of tall grass. By mid-winter the herds were generally in close association with sheltered ravines or wooded areas.

As spring approached, the herds moved back into open areas and toward the end of spring the calves were born after a gestation period of 285 days. These calves were born as early as April and as late as August. During summer, the herds had to provide themselves with water which forced them toward rivers and the many pothole-slough areas on the northern plains.

The life cycle of a bison began in the spring, as noted. The newborn calf could walk at birth and had a coat of reddish fur which it began to lose by August. By October, the coat had completely changed to a light brown. The calf was suckled for three to four months, then followed the mother to the next calving season. At that time it was half grown but continued to mature for the next three years. By then the female could give birth and the male had grown to 2 m at the shoulders and

weighed 816 to 1135 kg (1800 to 2500 pounds). The bison lived for about 25 years.



## THE ESTUARY BISON POUND

### LOCAL ENVIRONMENT

The site is situated right on the boundary between two distinct environmental zones. To the south is the natural, arid dune sand environment of the Great Sand Hills and between the dunes and the site is a band of slightly undulating Bouteloua - Stipa association grassland, most of which has been broken for agriculture. To the north is the river zone. This area includes all the land surrounding the South Saskatchewan River from its water level to where the eroded banks begin (Millar et al 1972:8-9).

The Saskatchewan River Lowlands are about 5 km wide at this point with an average elevation of 575 m above sea level. This region is characterized by river drainage and gently undulating plains formed primarily of glaciolacustrine silts and clays. There are some coarse delta and outwash deposits and modified till, but very little till plain. The bluffs between the two are steep, essentially devoid of vegetation, and dissected by long, steep walled coulee channels.

To the south of the site in the Great Plains province lie the Sceptre Plains. Here, the elevation is about 665 m and most relief is glacial in origin. Drainage is internal and the gently undulating plains are broken by great areas of dune topography.

The climate of this area is temperate relative to the rest of Saskatchewan. It is classed as Bsk of Koppen's modified climatic classification and is, in general, a semi-arid, cold steppe country, where the potential loss of water is greater than the precipitation received. The

vegetation and soils are of the grassland variety. Precipitation is low and highly variable. The normal daily mean temperature in January is  $-14^{\circ}$  C (with extremes ranging from  $-48^{\circ}$  to  $18^{\circ}$  C and normal daily mean temperature in June is  $19^{\circ}$  C (with extremes ranging from  $-2^{\circ}$  to  $43^{\circ}$  C). There are 100 to 120 frost-free days and less than 30.5 cm of precipitation per year. It is also in the extreme eastern edge of the Chinook Belt though effects are minimal.

The Estuary site itself is located at the head of the second longest branch of a large drainage coulee, about 2.1 km from the South Saskatchewan River (Fig. 3). Though the site is only 17 m below the prairies, the coulee elevation decreases over 90 m to meet the river plains. The coulee channel orients roughly north-south but the main coulee is perpendicular to it. It is probable that the channel went through two stages of development. It appears that water action cut the coulee down between 15 and 34 m. It was then widened by a process of erosion and slumping with subsequent colluvial deposition. Human occupation apparently occurred during this time. Most of the cultural layers are from .5 to 3 m below the remnants of the terraces that result from a period of considerable erosion. Recently, erosion has begun again, apparently at a quite rapid rate. During the past 40 years, the new coulee bottom has moved back at least 36.5 m and cut down about 6 m. At the same time, valley erosion and slumping are still occurring.

Within a few hundred metres of this site, there are three areas showing unusual amounts of moisture that could possibly have been springs, while within 15 km is a present-day runoff from a nearby spring.

The prairies of the area, when uncultivated, attain a climax of grasses and sagebrush (Artemisia cana). The predominant grasses are

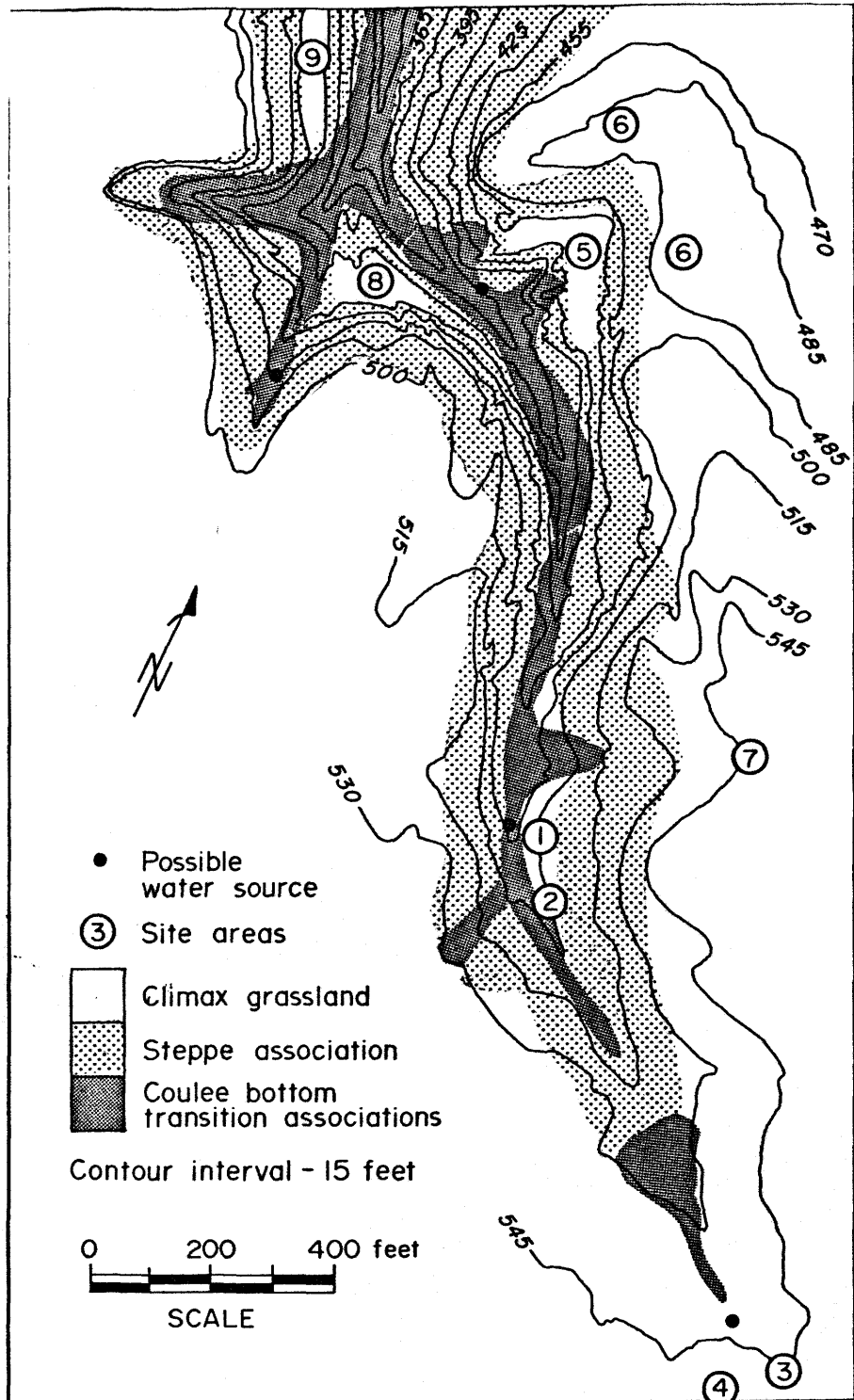


Figure 3

Topographic map of site

Similar specimens have been discovered in surveys of Pass Creek (Reeves 1972:224-5), the Belly River (Quigg 1974:128-9), the Suffield Reserve (Brumley 1972) and the lower Red Deer River (Adams 1976:87-88), all in Alberta.

#### CORE

Number. 1.

Location. L21.

Description. A single, large quartzite core is derived from a glacial cobble. Flakes are percussion removed. There appears to be little or no core preparation but flakes are removed by rotating the core so that prior removed flake areas act as a striking platform.

#### LITHIC INDUSTRY

The lithic industry of Level I is divided into four constituent parts: the artifacts, flakes, retouch flakes and fire-broken rock.

The 117 artifacts are composed of chert (33.3%), quartzite (42.1%), chalcedony (5.3%), petrified wood (14.9%), jasper (3.5%) and a quartzite to chert material (.9%). Of the chert, 18 are black, 5 are brown, 10 are grey and 4 are white. Many of the non-white artifacts are probably derived from local pebbles. There is also one specimen of Montana chert. All other specimens except for the four pieces of brown chalcedony are locally or regionally derived.

The 323 flakes recovered include 42 (13.0%) chert, 191 (59.1%) quartzite, 13 (4.0%) chalcedony, 46 (14.2%) petrified wood, 6 (1.9%) jasper, 7 (2.2%) schistlike material and 18 (5.6%) pieces of undifferentiated materials including granite, limestone and metamorphic rocks. It is probable that all but the chalcedony are of local origin. Many of the

chert flakes and perhaps some of the chalcedony appear to be pebble derived.

A total of 83 flakes from Level I are sufficiently complete to allow non-metric analysis while 69 permit complete metric study. In the non-metric attributes, it appears that the key attributes are the striking platform characteristics and the flake orientation. Curvature, edge shape and bulbar attributes all demonstrated: (1) no diagnostic differences or (2) differences with no patterning beyond that explainable by random chance.

An examination of flake orientation reveals that 54.9% are parallel while 30.5% are perpendicular and only 14.1% are oblique. Also 39.1% have flaked striking platforms, 31.9% have unprepared platforms and the remaining 29% include battered (11.6%), chipped (14.5%) and roughened or ground (2.9%). Percussion flaking technique is inferred on 73.4% of the flakes while the remainder are pressure flaked. It is also noteworthy that while flaked platforms are found on approximately half of the perpendicular and oblique flakes, they compose only 28.9% of the parallel flakes. Also, while flaked platforms are often removed by pressure, very few of the others are.

A total of 5 measurements and three indices were computed for this group of flakes. In summary, the mean striking platform dimensions are 16.7 by 4.2 mm. The mean length is 24.0 mm, the width is 17.3 mm and the thickness is 6.3 mm. It is also noted that when these measurements are categorized by the method of striking platform preparation, there are definite size differences. The largest flakes have unprepared platforms with flaked, chipped, battered and ground platforms following in order of decreasing size.

speargrass (Stipa comata) and grama grass (Bouteloua gracilis) with a little wheat grass (Agropyron). The degree to which sagebrush is found increases with the amount of grazing. These species are supplemented by a variety of cacti and wildflowers. The grassland climax on the slopes of the coulee changes with a conversion to a steppe association of sagebrush (Artemisia cana), creeping juniper (Juniperus horizontalis), two species of cacti (Mamillaria vivipara and Opuntia polycantha), and a much smaller proportion of the local grasses. In the coulee bottom, where conditions are more sheltered and moist, there is a succession of associations. It begins at the head of the coulee above the site with a scrub association of snowberry (Symphoricarpos sp.), buffalo berry (Shepherdia argentia) and rose (Rosa sp.). Downslope, this is supplemented and eventually superseded by chokecherry (Prunus virginiana). Various willows (Salix sp.) and finally aspen (Populus tremuloides) in the lowest areas close to the river or spring beds. There are many plants in this area that could have been utilized by the native population. Of particular note for their abundance and potential value as a food source are the chokecherry, buffalo berry, cacti and rose and to a lesser degree, saskatoon and gooseberry (Budd 1957).

The good grazing prairie, proximity to water and variation of prairie, steppe and riverine micro-environments provides ideal conditions for an extensive list of mammals, of which the following is but a partial sample:

White-tailed jackrabbit	<u>Lepus townsendii</u>
Richardson's ground squirrel	<u>Spermophilus richardsonii</u>
Northern pocket gopher	<u>Thomomys talpoides</u>
Deer mouse	<u>Peromyscus maniculatus</u>
Beaver	<u>Castor canadensis</u>
Porcupine	<u>Erethizon dorsatum</u>
Coyote	<u>Canis latrans</u>
Swift fox	<u>Vulpes velox</u>
Raccoon	<u>Procyon lotor</u>

Least weasel  
Mink  
Striped skunk  
Badger  
Lynx  
Bobcat  
Mule deer  
White-tailed deer  
Pronghorn antelope

Mustela rixosa  
M. vison  
Mephitis mephitis  
Taxidea taxus  
Lynx canadensis  
Lynx rufus  
Dama hemienus  
D. virginianus  
Antilocapra americana

Also, within the historic past, the following species can be added:

Grizzly bear  
Mountain lion  
Elk  
Bison

Ursus horribilis  
Felis concolor  
Cervus canadensis  
Bison bison

Of special note in the bird assemblage are the ducks (Anas platyrhynchos), cranes (Grus canadensis), prairie chicken (Tympanuchus sp.) and various shore birds. Also of note is the fact that the prairie rattlesnake (Crotalus viridis) and the bullsnake (Pituophis melanoleucus) are quite prevalent in the immediate area, which probably accounts in part for the fact that the site is not plagued by a single rodent hole.

#### METHODOLOGY

##### SURVEY METHODOLOGY

Surveying and prospecting was carried out on two levels. The first survey was of a general nature, conducted simultaneously with a plane table survey. It was intended to locate and identify environmental changes; possible sources of wood, water, and other raw materials; and other prehistoric sites in the vicinity. This survey revealed that Ef0k-16 was in actual fact only a segment of a complex of sites, nine of which were tested and recorded (Fig. 3). Sites 1 and 2 were excavated as Ef0k-16. The others were fully examined for surface indications or were tested.

Site 3 was in a small V-shaped washout at the head of the coulee, 125 m to the south of the excavation. It was a buried horizon at a

depth of approximately 30 cm and showed as the bottom horizon of three dark layers. It was uncultivated and has produced several bone fragments.

Site 4 was located approximately 135 m west of Site 3 in the gentle slopes found at the very head of the coulee. It was at least partially a surface site and has yielded fine powdery bone fragments, flakes and fire cracked rock. It may have been associated with Site 3.

Site 5 was found on a terrace about 145 m north of Sites 1 and 2 and approximately 13 m below the coulee edge. It was probably located on the same coulee level as Sites 1 and 2. At least three cultural layers appeared in this site, each of unknown extent though all were partially destroyed by erosion of the former coulee bottom. Hearths appeared in each layer and artifacts included a scraper, knife, bone polisher, pottery sherds (all body sherds with no decoration, but apparently from two different pots), flakes and considerable bone.

Site 6 was found just above Site 5 on the rim of the coulee. It was at least partially a surface site and has yielded a few flakes and one small fragment of pottery. Its actual extent was unknown but may have been quite large.

Site 7 was located 90 m northeast of Site 1 on a small hill along the crest of the east coulee wall. This was one of the highest points on the coulee. A nearby cutbank indicated a cultural layer about a foot below the surface but confirming testing was not conducted. One surface find, a Plains Side-notched point, was recovered from this site.

Site 8 was located on a terrace at the same level as Sites 1, 2 and 5. It was located at the juncture of the main coulee branch with two other branches. This confluence probably led to the extensive erosion



in this particular area, destroying much of the site. The site itself consisted of two cultural layers, the lower being about 1.5 m below the terrace. Both layers contained bone and the lower showed evidence of at least one hearth. Various bones, a few flakes and a Besant projectile were recovered from this area.

Site 9 was situated 135 m northeast of Site 8, below the confluence of the two coulees on a terrace about 60 m in length and about 20 m wide. There are three cultural layers in this site, the top being very ashy and the lowest showing extensive burn. All three contain charcoal. Site 9 is on the west side of the coulee and again appears to be at the same elevation as the other terrace sites.

#### EXCAVATION

Excavation control was difficult to maintain due to the nature of the predominantly clay sediments. These tended to bake hard in the sun making trowelling difficult at best. Shovels were used to remove 30 to 100 cm of overburden and trowels were used only in the final few centimetres above the cultural horizons. One metre pits were used initially to establish control profiles but the main excavation units were two metres square arranged to yield the maximum amount of information (Fig. 4).

Very early in the excavation a profile was cut along the naturally eroding west edge of the site. Though this profile eventually resembled a battle trench, it provided useful information when tracing stratigraphy from one end of the site to the other.

All work within the cultural levels was done by trowel and/or grapefruit knife and brush. Excavation was stratigraphic in nature whenever possible but arbitrary levels were resorted to at times when the close proximity or high degree of similarity between levels caused temporary

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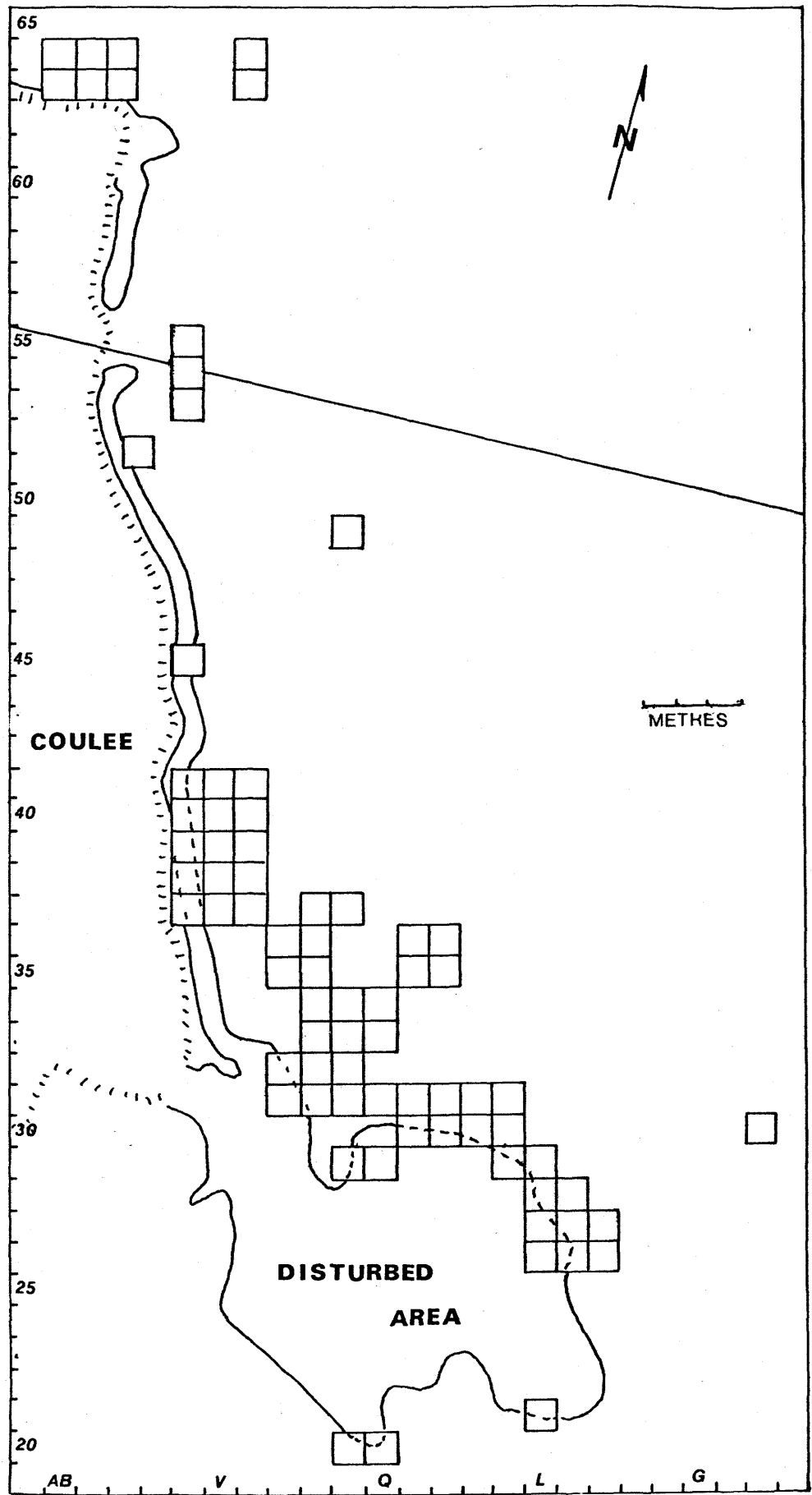


FIGURE 4

PIT LOCATION AND IDENTIFICATION MAP

confusion.

Records were kept by planviews of each level, photographs to coincide with each plan, daily journals kept by each member of the crew and profiles of all walls of each completed pit. The only true difficulty arose in keeping stratigraphic control as was previously indicated.

Screens were not used except as an occasional test. However, meticulous field techniques and usually careful work on the part of the crew led to the assumption that screens were essentially unnecessary. It is believed that the excavation obtained better than 90 percent recovery.

During the second year, essentially identical techniques were used but orientation changed. With a preliminary examination of the material recovered in 1971, it was found that certain specific questions needed to be answered, so a limited excavation was proposed for the following year. All pits sunk in 1972 were intended to solve some specific problem on dimensions of features, further delineation of features, or separation of stratigraphic components.

#### ANALYTICAL METHODOLOGY

In all artifact descriptions, the basic descriptive text and comparisons are treated as simply as possible. The number of specimens of each type, the location of their findings, basic descriptions, dimensions and comparisons are all treated in the text. Descriptions include short summaries of shape, areas of modification and use and the identification of key attributes that define the types. Further details of artifact retrieval are synthesized in Tables 1 to 5.

The definition of type is essentially one of shape and size. Typology of the projectile points follows standard Northwestern Plains sequences.

Typology of other lithics is broken into classes based on overall modification (bifaces, unifaces, bone tools, etc.) and types formulated on at least two distinctive attributes, unique to a single artifact or group of artifacts.

## STRATIGRAPHY AND DATING

The site is situated on a terrace remnant of a former U-shaped valley caused by slope wash. It is about 15 m below the prairie and 90 m above the river. The sediments deposited above the cultural levels are the result of periods of stabilization in an overall process that resulted in the formation of an extensive coulee system. These sediments are almost exclusively silts and clays deposited by a complex process of aeolian and colluvial deposition, interspersed with periods of aeolian or fluvial erosion and periods of stabilization, resulting in buried Ah soil horizons. These sediments extend 3 to 4.5 m below the surface in the southwest corner of the site but terminate less than 1.5 m below the surface in the northwest corner.

The basic stratigraphy of the site is described in a descriptive form from the surface to the cultural levels. To avoid the confusion that would result in a layer by layer description of the complex sequence, the depositional layers are grouped into three units, each with a set of similar characteristics. In some portions of the site these three units can represent as few as five layers in 50 cm of depth while in other areas they may represent up to 13 layers extending to a depth of 140 cm. All descriptions of grain size and colour are based on subjective readings taken in the field.

Within the excavated portion of the site, the surface unit is generally composed of a single layer of a fine, dark grey silt. In some areas, small hollows have tapped blowing dust to create a superimposing layer of light brown, sandy silt. In other areas, a second grey layer, similar

to the first, appears immediately below it. Together, these layers compose the surface unit which varies between 0.5 and 8 cm in thickness.

The second unit is composed of one or two layers of unleached, light yellow silt. Where the second layer occurs, it is separated by a thin, dark grey band of a possible buried Ah soil horizon. This unit varies from 2 to 30 cm thick.

The third unit is from two to six layers thick. All the layers are structurally similar, being composed of light to medium brown silts. They are all leached and a few have small percentages of sand grains included in them. They are usually separated by a thin line of dark grey silt. In total, this group varies between 30 and 50 cm thick, terminating between 40 and 90 cm below the surface.

The dark bands that appear between these layers appear to be the result of periods of stabilization and soil development. Occasionally a small fragment of butchered bone or a single flake would appear in one of these bands during the excavation but they were so rare that they were interpreted as a result of slope wash or some other natural transporting agency.

The cultural levels lie below this mixture of silt deposits. The first of these, Level I, is very thin and occurs in silts structurally similar to the above but scattered with a small amount of culture bearing material and a few flakes of ashes. The second, Level II, lies immediately below Level I on the east edge of the site, and is separated by a layer of yellow sandy silt on the west edge. It is characterized by the bone bed and a darker, richer soil with a higher degree of charcoal and organic matter contained within it. Levels IIA and IIB appear only in certain specific areas and are directly associated with Level II as

will be fully detailed below.

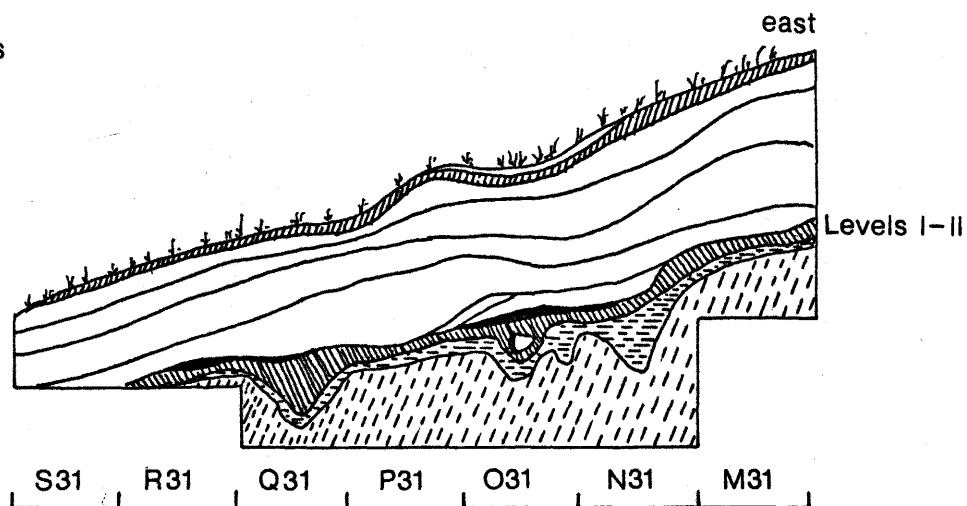
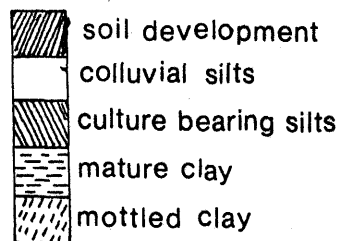
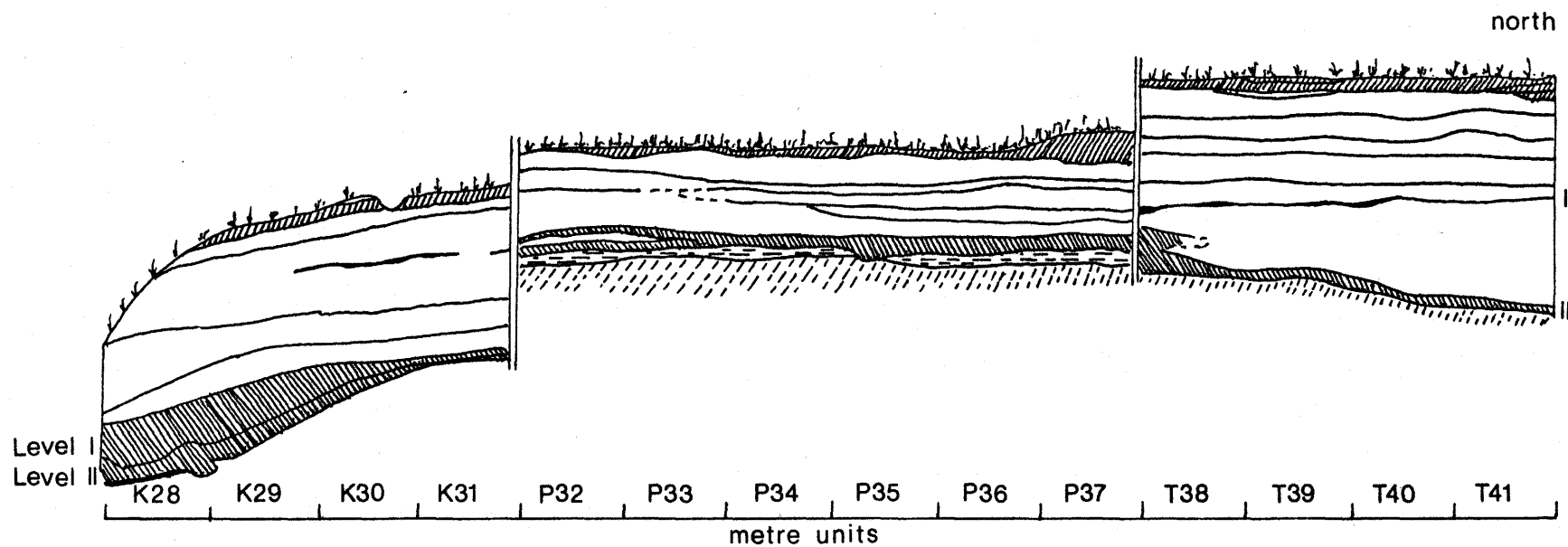
Beneath these cultural levels are heavily leached, stratified clays. These are varying thicknesses, extending down to the local interstadial sand (Fig. 5).

#### DATING

The dates from the Estuary Site are represented by a single carbon date and two collagen dates. The first date is from the feature C-2 and belongs to Level I. It reads at  $1020 \pm 80$  B.P. (GaK-3809:A.D. 930). A second Level I date is fixed at  $1070 \pm 70$  (S-640:A.D. 880), while the only Level II date is  $1190 \pm 165$  (S-641:A.D. 760).

While little comment can be made on the stratigraphic accuracy of these dates, they are typologically acceptable though somewhat late. Of further note is the close clustering of the dates which supports both the stratigraphic and typological indications of minimal time distance between the two occupations.

FIGURE 5



SAMPLE PROFILE



## LEVEL I

### FEATURES

The predominant features of this level included six identified hearths and three charcoal concentrations (Fig. 6).

#### Hearth H-1

Location: U38 and T37 (partially excavated).

Description: The hearth was flat and circular and had no lining. It measured 55 cm by 62 cm and contained charcoal and some sand. There was no burnt bone in the hearth.

#### Hearth H-2

Location: V39 and W39.

Description: It was ovoid and very slightly lensed in the centre. It measured 35 cm by 67 cm but never exceeded 8 cm in depth. There was a thick charcoal concentration along the west edge and a few small charcoal fragments scattered over the surface. There was also a thin layer of ash overlying the red-stained earth marking the bottom of the hearth.

To the north of the hearth were three holes, about 2 cm in diameter and 5 to 7 cm in depth. They were arranged in an arc and angled with the top toward the fire as though they might have been part of a rack or spit of some form.

#### Hearth H-3

Location: W40 and W41 (partially excavated).

Description: This hearth was partially destroyed in the preliminary trenching operation. The remainder was excavated, revealing

a flat bottomed, oval hearth. The longer, north-south axis measured 89 cm while the shorter dimension was 30 cm. It was very shallow, only 5 cm deep in the centre. It was filled with sand, ash, charcoal fragments, a few flakes and a large number of small, retouch flakes. The retouch flakes radiated out for about a metre beyond the hearth. The soil beneath the hearth had the usual red discoloration.

#### Hearth H-4

Location: V42.

Description: This was small, circular hearth, 65 cm in diameter and again, only 5 cm deep. The burned soil around the south and west perimeter displayed an irregular pattern. This took the form of a series of small, rough, ovoid concavities measuring 10 to 20 cm along the greater axis. Each concavity was separated by fire hardened mounds of earth. This arc-shaped area strongly suggested a lining of stones, later removed for some other purpose (Figs. 13, 14).

Extending from the hearth was a charcoal projection that measured 10 cm in length by 2 cm in diameter. This appeared to be a thin log, either partially removed from the fire or not fully inserted into it. The pit itself was filled with sand, ash and some charcoal.

#### Hearth H-5

Location: W46 (partially excavated).

Description: Though incompletely excavated, H-5 again appeared to be flat and oval shaped. Like H-4, this hearth had a perimeter of charcoal covered, red stained hollows and humps, suggesting a

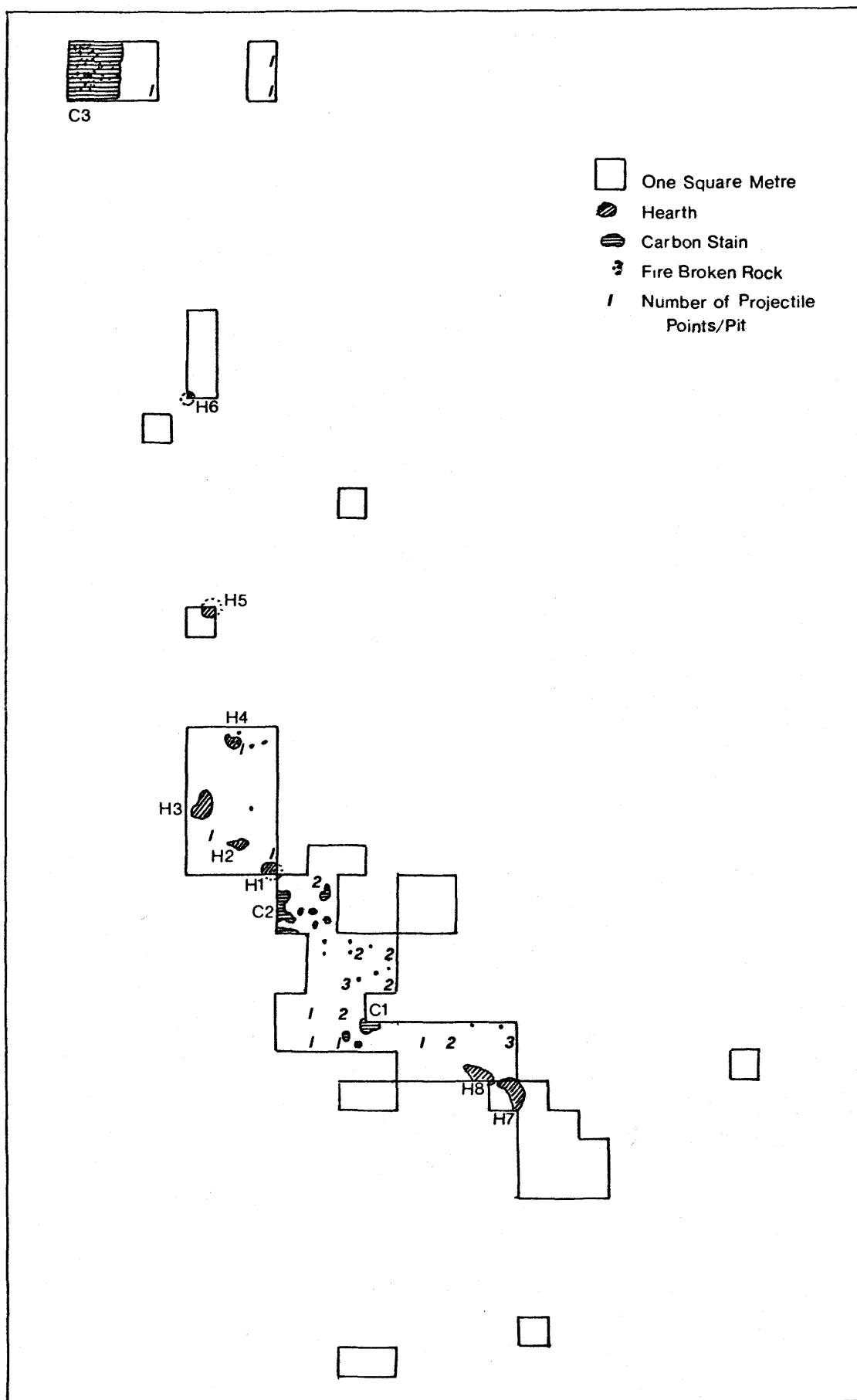


FIGURE 6

PLAN OF LEVEL I

rock lining. There were five charcoal impressions radiating from this hearth that suggested logs. Inside the hearth itself was some burnt clay and a few charcoal fragments.

#### Hearth H-6

Location: W54 (partially excavated).

Description: Only the corner of a hearth was uncovered at the southwest edge of this pit but it was definitely from the same cultural level as the above hearths and appeared to be flat.

#### Feature C-1

Location: Q32 and R32

Description: Charcoal concentration C-1 was actually composed of a series of three small deposits of irregular shape and indistinct outline. They were composed of a considerable concentration of charcoal but little ash and no sign of charcoal below. The largest concentration was 60 cm through its longest axis while the smallest was only 17 cm long.

#### Feature C-2

Location: R35, R36, S35 and S36.

Description: Within the above 4 m<sup>2</sup> were five small, irregularly shaped charcoal concentrations and two similar, large concentrations that were only partially excavated. The smallest area was only 22 by 10 cm, while the largest was 120 cm along its longest exposed axis. The charcoal was between 2 cm and 5 cm thick. This concentration could have extended from H-1.

#### Feature C-3

Location: Z63, AA63, AB63, Z64, AA64, and AB64.

Description: This charcoal concentration encompassed virtually

all of the 6 m<sup>2</sup> and extended into all but the east wall. This feature appeared to be some form of refuge pile, with up to 12 cm of charcoal deposited on flat ground. There was no evidence of burn stained soil beneath the carbon deposit.

The pile was particularly rich in cultural material including: 84 fire broken rocks, 383 flakes and retouch flakes, 4 shell fragments, 16 stone tools and over 100 bone fragments.

In summary, it appears that the hearths were a major aspect of Level I. They were built on flat ground with little or no preparation. The primary fuel was wood, probably dead brush from the lower portions of the coulee. They were likely used intensively as evidenced by the large, additional deposits of carbon. Furthermore, the scarcity of surface rocks suggested that any rocks used in conjunction with the hearths were later used in some other context.

Comparisons to similar hearths from other sites of the Northwestern Plains were possible but the sample was limited. Both the hearths at the Bakken-Wright site (Adams 1975) were related to Component C, a middle to late Old Woman's Phase level, and one of these was flat. Two possibly flat hearths were described as "surface burns" in the Old Woman's Phase level of DhPj-11 and were obsidian dated at A.D. 482 - A.D. 1047 (Quigg 1974:22). A stone-lined surface hearth was also discovered by Quigg in DgPk-75 and was dated at A.D. 364 - A.D. 1465. It was 120 cm in diameter, irregularly circular and surrounded by nine surface stones. There were also minute bone fragments and associated tools and flakes that indicated tool manufacture and hide working (ibid:31). Several lenslike hearths were found at the Morkin site in southern Alberta, apparently throughout the sequence represented in the site. This included Besant, Avonlea and

late side-notched affiliations (Byrne 1971). Occupation VI of the Sorenson site, dated at A.D. 640  $\pm$  100, had nine hearths. Only one of these was flat but all were circular to oval without a rock perimeter (Husted 1969:21). Finally, at Rock Creek Cave in Wyoming, dated at A.D. 975  $\pm$  180, 15 of the 20 hearths were rock lined, shallow or slightly hollowed depressions (Anonymous 1969). Other accounts of flat hearths in Late Prehistoric components were found in reports of the Ross site, a late campsite in southern Alberta (Forbis 1960) and at the Wahkpa Chu'gn Buffalo Jump in northern Montana (Davis and Stallcop 1966).

There were even fewer references to refuse piles in the literature. Prepared refuse piles were found at Bakken-Wright (Adams 1975), and at Morkin (Byrne 1971). An ash pit of irregular dimensions and filled with a dense concentration of small bone fragments, charcoal, ash and stones was reported at the Boarding School Bison Drive in Montana (Kehoe 1967:34). However, all these reported incidents had some evidence of preparation of the pit before use. No such indications occurred at Estuary.

#### LITHIC ARTIFACTS

##### PROJECTILE POINTS

###### TYPE I

Number. 28 diagnostic, 11 fragments (Fig. 18a-aa).

Location. Throughout the excavation with the greatest concentration in the south-central pits.

Materials. 13 local chert, 1 Montana chert, 3 brown chalcedony, 2 local chalcedony, 4 petrified wood, 1 jasper, 1 chert-quartzite, 14 quartzite.

Description. The diagnostic projectile points are generally

characterized as side-notched and triangular with an asymmetrical body outline. The notch is U-shaped, broad and shallow. The basal edges contract toward the base which has an obtuse to square basal juncture. The bases are thinned and 7 (25%) are ground. The cross-sectional shape is biconvex and the longitudinal shape is biconvex to excurvate. The haft element is asymmetrical. A few of the attributes do show considerable variability within the group. While 23.1% of the points have straight bases, 34.6% have slightly concave bases and 42.3% have convex bases. Though 28% have both shoulders rounded and 32% have squared shoulders, the remaining 40% have one of each. Finally, while 61.5% have bases wider than blades, the remainder are reversed.

One specimen is of note because it appears as if one basal juncture has been completely worn off by grinding.

<u>Dimensions.</u>	Length:	13 - 22.5 mm	mean 19.2 mm
	Width:	9.5 - 19.0 mm	mean 13.6 mm
	Thickness:	1.5 - 4.8 mm	mean 3.4 mm
	Notch Length:	1.4 - 4.5 mm	mean 2.1 mm
	Notch Depth:	1.0 - 4.0 mm	mean 3.3 mm

Comparisons. Comparisons are a little difficult because I have taken what have been referred to as three or four varieties of Prairie Side-notched points and lumped them together. It appears that any conceivable splitting of this group is going to be based on one or two attributes and no more.

Two specimens have very low notches, a convex base and wider blade than base. These can be associated with the Lewis variety

(Forbis 1962:100, Kehoe 1966:831, Kehoe 1973:59, Adams 1975:156). Three specimens have narrow, convex bases and wide notches that resemble the Swift Current Fish-Tail (Kehoe 1966:831). Another two are small with straight bases and could be described as High River variety (Forbis 1962:102, Kehoe 1966:831). The remainder belong to a continuum of amorphous Prairie Side-notched and the Nanton and Tompkins varieties (ibid).

## TYPE II

Number. 1 (Fig. 19v).

Location. 032.

Description. This singular point is triangular with no notches, slightly excurvate edges and a straight, thinned base. There is primary flaking on both sides and secondary retouch on both sides of the base and the left edge.

Dimensions. Length: 18.8 mm

Width: 16.2 mm

Thickness: 4.4 mm

Comparisons. Unnotched, triangular points are common in Late Prehistoric sites but are often glossed over due to their lack of diagnostic characteristics. However, mention is included by Forbis at the Old Woman's site (1962:103). Kehoe (1973:106) refers to them as small, pointed knives and compares the Gull Lake site specimens with others from Pictograph Cave, the Upper Yellowstone, Dodd site and Hagen site, all in Montana.

Brumley (1972) and Adams (1976) both recovered a large number of small triangular bifaces as the result of surveys along the South Saskatchewan and lower Red Deer River in southeastern



Alberta. In both cases these specimens are assigned projectile point status and are tentatively typed as either Avonlea or Old Woman's Phase related material, depending on overall size, shape and workmanship. The Avonlea specimens are considered to be smaller, thinner and better worked with flat bases and relatively sharp corners.

## BIFACES

### TYPE I

Number. 4 (Fig. 21a-c).

Location. AB64 and trench from W37 to W42.

Materials. 1 chert, 2 jasper, 1 quartzite.

Description. Though only two specimens are complete, all conform to a similar form. The proximal end is straight but skewed while the distal end is pointed. While both lateral edges are excurvate, one side has double the curvature of the other.

The larger specimens show edge sinuosity but the smaller ones do not. The cross-sectional shape is asymmetrical biconvex. They have primary retouch on both sides and secondary retouch in isolated locations to smooth rough edges or to break down steep angles. The maximum width is always to the proximal end.

Measurements. Length: 35.3, 46.7 mm

Width: 19.9, 25.6 mm

Thickness: 5.4 - 11.9 mm mean 7.8 mm

Comparisons. Apparently similar specimens have been recovered from Level 1B of the Mortlach site (Wettlaufer 1955:29), Level 2 of Long Creek (Wettlaufer 1960:41), Pictograph Cave III (Mulloy 1958:52), the Timber Ridge site (Davis 1966:103) and

Gull Lake 6-8 (Kehoe 1973:106-7). Most of these components are considerably later in the time sequence than is indicated at Estuary.

#### TYPE II

Number. 1 (individual specimen) (Fig. 21f).

Location. Trench outside W39.

Material. Quartzite.

Description. This is a symmetrical, lanceolate biface with one basal corner removed. The proximal (basal) end is straight while the distal end is pointed. The base is slightly thinned and the notch is heavily ground. The cross-sectional shape is asymmetrical biconvex and the longitudinal cross-section is biconvex. It is well worked with primary and secondary retouch on both faces and apparent use retouch on the dorsal, distal end of the right side.

Measurements. Length: 42 mm

Width: 20.3 mm

Thickness: 7.1 mm

Comparisons. The only known comparable specimens of contemporary age are from the Old Woman's site (Forbis 1962:Fig. 17B) and from the Saco site (Hoy 1973:9 Fig. 3-n). Both of these are from what appears to be early Prairie Side-notched components.

#### TYPE III

Number. 1 (individual specimen) (Fig. 21g).

Location. R32.

Material. Petrified wood.

Description. This specimen has a straight proximal end, excu-

vate distal end and left lateral edge and incurvate right lateral edge. Corner-notches are cut into both edges about 10 mm from the base, giving it a stemmed appearance. There is secondary flaking around the perimeter, bifacial retouch along the left edge and step flaking on the proximal end of the right angle.

Measurements. Length: 49 mm  
Width: 28 mm  
Thickness: 7.6 mm

Comparisons. No comparable specimens are located in the literature.

#### TYPE IV

Number. 5 (Fig. 21i-m).

Location. AB53, W40, and three from trench near W39-W41.

Material. 2 chert, 1 jasper, 1 petrified wood, 1 quartzite.

Description. These bifaces are apparently not intentionally modified flakes but rather ovoid to sub-rectangular flakes. Bifacial edge retouch occurs around the straight to slightly convex lateral edges and one end. The opposite end is broken on four of the specimens. Four of the specimens are on thin flakes and three of these have slight concavities on the proximal end. The fifth is about twice the size of the other specimens.

Measurements. Length: 23.7 (1)  
Width: 16.5 - 24.2 mm mean 17.9 mm  
Thickness: 3 - 10.5 mm mean 3.8 mm

Comparisons. These seem to be similar to the "regular flake knives" found throughout the Gull Lake site (Kehoe 1973:105),

and at DhPj-11 (Quigg (1974:112)).

#### TYPE V

Number. 1 (individual specimen) (Fig. 21h).

Location. W41.

Material. Quartzite.

Description. This specimen has a triangular form with an excurve skewed base. The left edge is excurve at the proximal end, incurvate at the distal end. The right edge is excurve. It is asymmetrical biconvex in cross-section. The base is thinned and there is complete bifacial primary flaking on both surfaces.

Measurements. Length: 39.1 mm

Width: 19.0 mm

Thickness: 7.9 mm

Comparisons. This specimen is most similar to material from western Alberta sites. These include the Trial Type 8 bifaces from the Belly River (Quigg 1974:Fig. 20:6-8), Trial Type 12 bifaces in Pass Creek (Reeves 1972:Plate 12:12-15), and the Ross site (Forbis 1957:Plate 1:3S). In contrast, contemporary, triangular bases from Gull Lake and Pictograph Cave III (Kehoe 1973:106 and Mulloy 1958:52) are smaller, thinner and symmetrical.

#### TYPE VI

Number. 2 (Fig. 21n-p).

Location. Q35.

Material. Black chert, petrified wood.

Description. These specimens represent a portion of a thick lanceolate biface with a rounded distal end. The material has complete primary flaking on both surfaces. They are biconvex

in cross-section and ovate in longitudinal-section. One specimen has step flaking on the right edge and some use retouch on the left.

Measurements. Width: 14.5, 8.7 mm

Thickness: 7.3, 4.3 mm

Comparisons. If one uses the lanceolate form with at least one end pointed as primary attributes, then disregards symmetry and size, this artifact style has numerable comparisons among Avonlea and early Old Woman's phase sites. Similar artifacts have been found at the Bakken-Wright site (Adams 1975:161), the Gull Lake site (Kehoe 1973:107), Old Woman's site (Forbis 1962:113-115), the Belly River survey (Quigg 1974:111).

Kehoe (1973:107-8) lists a large number of sites throughout the Northern Plains as having similar style knives. However, there appears to be a tendency towards larger, less well formed specimens in the later time periods. This is particularly indicated by late variants at the Boarding School Bison Drive (Kehoe 1967:54) and at the Kobold site (Frison 1970b:20).

#### TYPE VII

Number. 6.

Location. Y53, AB62 (2), AB63, and two from the trench.

Materials. 5 petrified wood, 1 jasper.

Description. Though unique in size and form, these six diverse specimens are lumped together because they have five attributes in common. They each have only one lateral edge retouched for use; the opposite edge is unretouched; both ends are somewhat straight and skewed with one end wider; the blade is thinned;

and they are made from materials that are difficult to flake. This last attribute causes these artifacts to share other related attributes that include the irregularity of form, thinness, minimal edge retouch and use of natural cleavages.

Measurements. Length: 25.7 - 82.7 mm mean 49.8 mm  
Width: 12.1 - 28.5 mm mean 19.7 mm  
Thickness: 2.6 - 13.5 mm mean 6.3 mm

Comparisons. These specimens compare very well to the "irregular petrified wood knife" found throughout the Gull Lake site (Kehoe 1973:105), and at the Boarding School Bison Drive (Kehoe 1967:55). They are also mentioned in the retrieval from the Ross site (Forbis 1957:Plate 2-10).

#### MISCELLANEOUS

Number. 19 (Fig. 22a-f).

Location. Thirteen from the north half and six from the south half of the site.

Material. 9 quartzite, 3 petrified wood, 1 black chert, 1 jasper, 1 brown chalcedony, and 1 metamorphic silt material.

Description. These specimens are characterized as bifacially retouched flakes. There is no obvious deliberate attempt at form preparation. Some have retouch around the entire perimeter. Many specimens are broken and may actually be representative of other groupings. There are four possible Type I bifaces and two possible Type VI bifaces.

#### END SCRAPERS

##### TYPE I

Number. 6 (Fig.23a-f).

Location. 5 from north half of the site and one from the south half.

Materials. 2 black chert, 1 jasper, 1 brown chalcedony, 1 grey chert, 1 quartzite.

Description. The six end scrapers have all been grouped together. They are all ovate in shape with the distal end steeply flaked to provide a working edge, always wider and generally higher than the proximal end. They are plano-convex in cross-section with flaking on both lateral sides from the proximal end to the mid-point.

One specimen is formed from a split, black chert pebble and has a biplanar cross-section. The others are from thick flakes with minimal form shaping.

<u>Measurements.</u> Length:	18.8 - 23.3 mm	mean 20.5 mm (3)
Width:	13.7 - 31.0 mm	mean 20.0 mm (5)
Thickness:	5.4 - 10.5 mm	mean 6.9 mm (6)
Edge angle:	30° - 80°	mean 61.7° (6)

## TYPE II

Number. 1 (Fig. 23p).

Location. S37.

Material. Quartzite.

Description. While essentially similar to the above specimens in form and manufacture, it is distinguished by size. It is over three times the size of the other end scrapers. The distal end of the scraper is the widest part and it has had flakes removed from ventral to dorsal side to produce the working edge. There are some indications of use retouch on the right side of

the distal end.

Measurements. Length: 60.3 mm  
Width: 41.0 mm  
Thickness: 19.5 mm  
Edge angle: 70°

#### SIDE SCRAPERS AND/OR UNIFACES

TYPE I (Fig. 24a-f).

Number. 13.

Location. V39, V38, R36, W41 and 9 from Feature C-3.

Materials. 6 quartzite, 3 dark chert, split pebbles, 2 petrified wood, 2 chert.

Description. This group of unifaces is characterized by having been formed on flat, longitudinal flakes with one or more edges unifacially retouched to form a bevel. There is little or no evidence of form shaping.

Only three specimens have two beveled edges, but on all three, the edges are adjacent and form some degree of a point. One working edge is concave while five are straight and nine are convex. All specimens have virtually flat ventral surfaces and at least some a partially flat dorsal surface.

Measurements. Length: 25.9 - 43.6 mm mean 30.3 mm (8)  
Width: 5.3 - 37.0 mm mean 19.7 mm (7)  
Thickness: 3.3 - 14.2 mm mean 6.2 mm (13)

#### TYPE II

Number. 4 (Fig. 24n-p).

Location. U38, W41 and 2 from Feature C-3.

Materials. 4 quartzite.



Description. All four specimens have marginal lateral retouch along one or two lateral edges of a long, narrow, thick flake that is triangular to trapezoidal in cross-section. At least one of these flakes closely resembles a blade in appearance. The retouch on all specimens is in the form of small, conchoidal flakes removed from one edge. There is no evidence of an attempt to alter the flake form or to create an artificial bevel.

Measurements. Length: 24.4 - 38.8 mm mean 31.8 mm (3)  
Width: 10.0 - 15.5 mm mean 12.8 mm (4)  
Thickness: 6.5 - 15.4 mm mean 9.8 mm (4)

### TYPE III

Number. 7.

Location. 031, V39, 036, W41, 1 from the trench and 2 from Feature C-3.

Material. Quartzite.

Description. These specimens are all flakes or core fragments of various irregular dimensions on which at least a portion of one edge bears unifacial retouch flake scars. While one specimen appears to be an incomplete, broken biface, the remainder show no affinity to described artifact groupings.

Comparison of end and side scrapers is very difficult, due to a lack of conformity of description and the wide variety of overlapping attributes. The Type I end scrapers resemble the end scrapers of most Northwestern Plains Late Prehistoric Period sites. However, Kehoe (1973:90-100) types his end scrapers on the basis of degree of cortex removed while Quigg (1974:115) and Reeves (1972:187) describe their types on the basis of shape and degree of lateral retouch. Similar

situations occur among classifications of side scrapers.

In this treatment, the artifacts are lumped as much as possible. The traditional breakdown between end scrapers and side scrapers is one between distal end retouch and lateral retouch. Further typing beyond this is based on the shape and size of the unfinished flake.

#### PIÈCE ESQUILLÉES

Number. 4 (Fig. 26a-d).

Location. N31, V38, Z62, Z64.

Materials. 2 chert, 2 quartzite.

Description. All four specimens display bipolar battering and wide lateral edges with some cortex on one. The flakes are small but thick and the battered ends show scars along a straight, thin edge.

Though bipolar percussion is not an unusual method of flake manufacture on the Northwestern Plains, especially from small pebbles, the battering on these artifacts may be from use. One specimen shows definite smoothing on the arrises and ridges from the proximal end to the mid point of the flake. A second flake has definite battering, some retouch, and a possible striking platform along one of the lateral edges. The two quartzite specimens are tertiary decortication flakes. Both are biconvex in cross-section with extremely thick mid sections.

Measurements. Length: 28.3 - 45.3 mm mean 33.8 mm

Width: 19.2 - 25.5 mm mean 21.6 mm

Thickness: 5.6 - 14.4 mm mean 11.0 mm

Comparisons. Recognition of "pièce esquillées", "bipolar flakes" or "wedges" have been relatively frequent in recent years.

The retouch flakes are essentially unanalyzed. There are over 200 retouch flakes represented from Level I which range between 1.5 and 20.5 mm in length. Approximately half are thin, curved flakes with multiple arrises which are indicative of a pressure flaked secondary retouch while the other half are shatter fragments, often with no diagnostic flake characteristics.

The material composition is not too surprising. Between one-third and one-half of the flakes are some form of quartzite. Other materials in decreasing proportions are petrified wood, black chert, brown chalcedony, a variety of various coloured cherts and chalcedonies of local origin, jasper, and a schistlike material. The most unusual aspect of this is the high proportion of brown chalcedony, of which all are very thin retouch flakes. There is also one small obsidian retouch flake.

The fire cracked rock is represented by 66 plotted fragments most of which are under 10 cm in length. They all appear to be from glacial pebbles, unavailable at the site but easily gathered from around the rim of the coulee. Materials are generally quartzite, granite and limestone, all common in till gravels.

#### BONE TOOLS

As the greater proportion of bone tools is located in Level II, the full description and comparison is conducted in that section. Numbers, types and key words are all that is represented in this section.

#### TYPE IIA

Number. 9 (Figs. 29, 30).

Description. Large pointed bone tools.

Bones. Eight artifacts are on rib mid sections. Half of these are under 15 cm and the remainder are on longer bones.

The remaining specimen is on an unidentifiable fragment of long bone.

#### TYPE IIB

Number. 2 (Fig. 31).

Description. These very small, sharp versions of the above are described by Kehoe (1973:127-31) as "miniature awls".

Bones. All five specimens are on small fragments of rib.

#### TYPE IIC

Number. 2 (Fig. 31).

Description. These are similar to IIB but are ground to a complete form.

Bones. Both specimens are probably on rib fragments though positive identification is difficult.

#### TYPE III

Number. 12 (Figs. 32, 33).

Description. The tool appears as a flat end, probably used somewhat as an endscraper.

Bone. All 12 specimens are on unidentifiable long bone fragments. This differs dramatically from Level II where these tools occur most often on ribs.

#### TYPE IV

Number. 14 (Fig. 34).

Description. These smaller, bone tools have well worn, rounded ends and are alternately referred to as knapping, flaking or polishing tools.

Bones. Four of the tools are on rib fragments; the remainder are on unidentifiable long bone pieces.

## BISON REMAINS

Skull and Mandible. Three associated maxilla fragments, six ramus pieces, two hyoid bones, an ear ossicle, five mandible fragments and eight miscellaneous scraps of bone completed the entire inventory. This indicated a minimum of two skulls. The bones showed complete sectioning of the mandible and removal of the maxilla area, but very little else was evident as far as butchering was concerned.

Body. Only 13 nearly complete vertebrae were represented. Of the five cervical vertebrae, three were missing the spinous process and two of these were removed by sectioning the bone through the vertebral foramen. The eight thoracic vertebrae included one with a missing spinous process, two broken through the vertebral foramen, and five individual vertebral heads. One axis bone was split laterally through the vertebral foramen. There were also 35 miscellaneous vertebrae fragments, many of them broken sections of spinous processes.

One right glenoid process was the only identifiable scapula fragment, just as a single piece of tuber coxae or tuber ischii was the only scrap of pelvic bone. There were no sacrum or lumbar vertebrae represented. The rib fragments totalled 117, of which two were complete and the remainder were fragments of various sizes. The most numerous category of 80 bones (68.4%) were pieces less than 15 cm long.

Forelimbs. Only one humerus fragment, a left distal end, was found. It has the shaft broken 5 cm above the fossa with a split down the shaft that had removed the fossa and lateral condyle. The two, right proximal radial ends were both broken at the base of the shaft. This removed the posterior surface in the process. One ulna had the epiphysis missing while the second had the shaft split.

The podial elements included three complete right metacarpals; one left proximal end with virtually no shaft; and three left distal ends, two with articulating phalanges. One of the complete metacarpals also articulates to a group of phalanges. One ulnar carpal, two radius carpals and a number of smaller carpals and phalanges complete the inventory.

Hindlimbs. The only hindlimb long bones recovered were three distal tibia ends. One of these was a right epiphysis while the others were left and right ends broken at the base of the shaft. One complete, right metatarsal was found as were three proximal ends and two distal pieces, all of which had long portions of shaft and four of which were split along the shaft. There were also two right fourth tarsals, two calcanei, three lateral malleoli, several smaller tarsal bones and phalanges excavated.

On the basis of right metacarpals, the minimum number of individuals represented in the excavation was four. If some of the debated bone were included this sample may have been raised to six or seven animals. Of this bone, there were only four complete larger bones, all of them metapodials.

#### NON-BISON REMAINS

The largest group of non-bison bones recovered from Level I was a complete set of right podial and metapodial elements of a large canid (probably Canis lupus). Unfortunately, these all concentrated at the south end of the excavation, in one of the disputed pits. The only other bone represented was a left metacarpal from an antelope (Antilocapra americana). There were also several fragments of Unio shell, most from Feature C-3.

## INTERPRETATION

### OVERVIEW

The features were probably the most significant aspect of Level I. These features included 6 to 8 hearths and a number of charcoal concentrations. They aligned with a north-south orientation that paralleled the bottom of the coulee and extended from one end of the excavation to the other. However, occupation signs became more diffuse to the south and were non-existent in the test pits to the east.

The features themselves were basically of three types. The hearths were of a single type in that they were flat, ovate, used wood for fuel and were between 60 and 90 cm long. All the charcoal concentrations but C-3 were probably just scattered from the hearths. Feature C-3 suited no function so much as that of a large refuse pile.

Despite the basic uniformity of the hearths, there was considerable evidence that certain of these hearths had specialized functions. H-2 had the small peg holes that gave the impression of a roasting pit. H-3 was surrounded by retouch flakes suggesting its use in conjunction with knapping activities. This did not necessarily imply heat treating, however, as there was very little indication of heat treating on the artifacts unless it was very superficial. Hearths H-4 and H-5 appeared to have subsequently removed rock rims. This suggested that part of the function of the fires was to heat those stones for some other purpose. Hearths H-1, H-6, H-7 and H-8 were all generalized in character.

The artifacts consisted of 40 projectile points, 38 bifaces, 30 unifaces, and 64 bone tools. The projectile points were all classified as Prairie Side-notched though variety typology was essentially ignored. Nine of the bifaces appeared to be worked into one of five specific

forms or types while the 29 others divided into three less specific types. The thirty unifaces included seven endscrapers and 22 sidescrapers. Again typology was generalized. Besides these, there were four tools that showed bipolar utilization and were classified as *pièce esquillée*s. The bone tools were classified into three large groupings, based on the shape of the working edge.

The raw materials for tool manufacture were essentially all local in origin. The bone came from animals being butchered on the spot. Lithic materials were almost all retrieved from river and field cobbles. The few imported pieces included brown chalcedony from the Dakotas; Montana chert from that state; and obsidian, probably from Wyoming. There did not appear to be any connection with the mountain derived materials of the west.

The faunal remains were almost entirely bison. With the exception of Feature C-3 and the possible exception of the south edge of the excavation, the bone was fairly evenly distributed throughout the site. It was primarily small, undiagnostic fragments, seldom burnt, mixed with a collection of non-torso bones, such as the lower limb sections and skull. The only other faunal remains were the possibly intrusive antelope bone and canid bones of questionable provenience and some shell fragments from C-3.

Distributions added little else to the nature of the site. The features extended in an almost straight line that followed the course of the coulee and ended with the large C-3 refuse dump. The stone artifacts concentrated in the south half of the excavation and the dump. Bone remains were evenly distributed at 25-50 bones per metre in the south half and less than 25 bones per metre in the north except



for the denser concentrations in C-3. Fire broken rock gathered in two areas. The first was between Features C-1 and C-2 while the second was in C-3. Retouch flakes were in greatest profusion between H-3 and H-4 and again, in Feature C-3.

#### SITE UTILIZATION

From the above, it seemed likely that two alternatives were possible to explain the function of Level I. The first option was that the site was a campsite. As far back as Kehoe (1960) it has been hypothesized that Late Prehistoric bands used tipis in open areas for their summer camps. Since there were no tent rings at a site that almost certainly fell within the period of their use, and since the site was sheltered rather than exposed, it was speculated that the site would have been either a winter camp or a very temporary summer camp. The concentration of hearths, the number of artifacts and immense size of the refuse area strongly argued for the former.

The second alternative was that the site functioned as a butchering-processing activity area for a nearby drive site. This was indicated by the specialized nature of the hearths, the abundance of bone tools, the high ratio of projectile points and the use of bison to the exclusion of all else. Furthermore, the lack of certain goods was almost as significant as the inclusion of others. There were no ceramics, no large stone tools, no grinding implements, no ornamental artifacts and practically no indication of extensive preparation on any of the excavated bone or stone artifacts.

#### ACTIVITIES

From the various remains, it was apparent that three primary activities were being undertaken in Level I, which may or may not have been

associated. These were lithic preparation, bison processing and the extensive use of fire. As has already been noted, both of the first two industries were conducted in association with fire.

The butchering conducted at the site seemed to be of a secondary nature. The small fragments and larger, non-torso bones suggested that the good meat sections had been carried away and these scraps were worked over for marrow and/or scraps of meat. However, there was too little remaining to get a good indication of the butchering techniques.

The lithic industry was being conducted in several stages. There were few large quartzite flakes and fewer still primary decortication flakes though most of the pieces were of local origin. This strongly suggested that the quartzite cobbles were broken up at their source. The usable pieces were retrieved and broken down by percussion techniques to form tools. The petrified wood and local cherts and chalcedonies were probably brought as pebbles, perhaps already split once to determine the nature of their interiors. These were then worked into artifacts, often utilizing a bipolar percussion. As there was absolutely no evidence of reject flakes of imported materials, it was assumed that they were transported to the site in a finished condition. Finally, secondary re-touch, resharpening and edge altering was conducted on any tool that required it. Most of this last stage was conducted around H-3.

## LEVEL II

### FEATURES

There were 30 separate features excavated in Level II which seemed to group into 10 feature complexes (Fig. 7).

#### Hearth H-9

Location. R33 and S33.

Description. This hearth was unique to the site in that it was the only hearth that was positively dug out before use. It was cone shaped with a circular rim measuring 30 cm in diameter and was 16 cm deep in the centre. The surrounding soil was burned the familiar red, positively identifying it as a hearth. It was also coated with a 2 cm thick layer of white ash and filled with a matrix of charcoal, burnt bone chips and ash.

#### Hearth H-10

Location. U39, U40, V39 and V40.

Description. This was the largest single hearth in the site. It was ovular in shape, measuring 115 cm along the east-west axis and 50 cm along the shorter axis. The hearth was virtually flat with a thin layer of carbon and ash and a quantity of broken bison long bones. It also incorporated two associated features.

To the immediate north of the hearth was a charcoal stain that extended the length of the fired area and varied from 30 to 38 cm in width. It never exceeded a centimetre in thickness.

At the north end of this stain was a large rock measuring 50 by 33 cm by 19 cm in height. It had a flat upper surface, a still

flatter bottom and was noticeably fire-stained (Fig. 15).

#### Feature C-4

Location. Q32, R32, S32, Q33, R33, and S33.

Description. Carbon stain C-4 was between 20 and 70 cm in width, extending in an essentially east-west direction for a full 3 m. It was between 0.5 and 3 cm thick and contained a considerable number of bone fragments and flakes.

#### Feature C-6

Location. 031 and 032.

Description. This feature consisted of a thin, irregularly shaped carbon stain, very similar in appearance to C-4. Its maximum length was 120 cm in a roughly north-south direction while its width varied between 30 and 75 cm. It encircled three post holes but did not intrude over them.

#### Feature C-7

Location. S37, S38, T37 and T38.

Description. This carbon stain differed from the others in the level in that it was thinner and more diffuse. It actually appeared as a series of small, roughly circular to ovate concentrations centering in the stated pits and extending to neighbouring areas. None of the stains approached a centimetre in thickness.

#### Feature S-1

Location. L28 and L29.

Description. A red discolouration of the soil was about 60 cm long, 20 cm wide and up to 5 cm thick. Besides colour, it was distinguished by a light, uncompacted texture. It occurred within the pound and several bones were found in or around it.

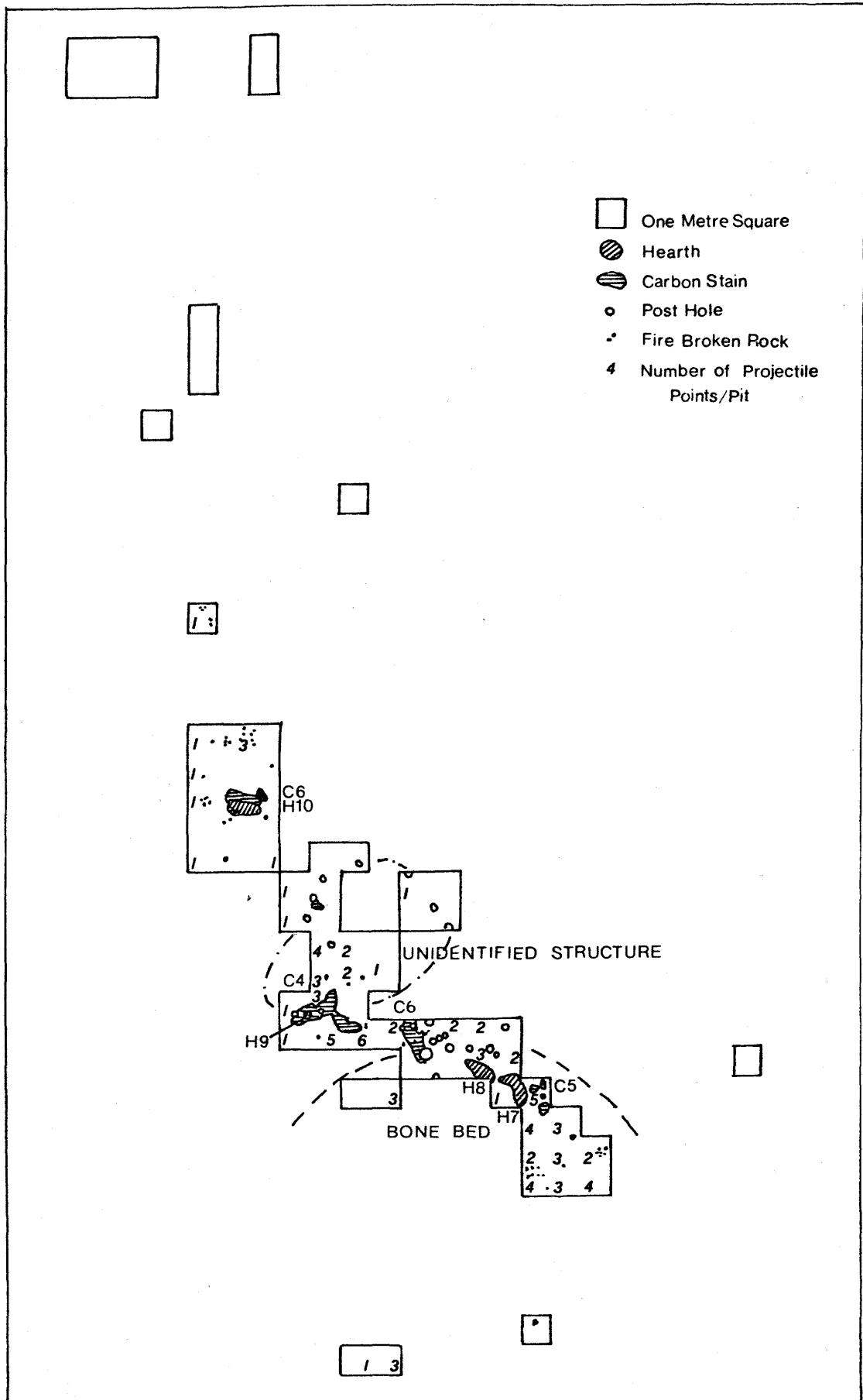


FIGURE 7

PLAN OF LEVEL II

Most of the features in Level II were postholes. Since they seemed to be somewhat organized into patterns, they are discussed in groupings rather than individually.

#### Features P-1 and P-2

Location. R33 and S33.

Description. These two holes were located approximately 20 cm east and west of H-9. Posthole (P-1) west of the hearth consisted of a semicircular burn stain and scattered charcoal fragments, angled into the ground at about 70° west. It gradually dissipated, leaving no visible remains on the west edge. The second hole increased in diameter as it deepened and was filled with an intrusive sand. This may have been a large rodent or badger burrow; however, as there were no other burrows in the entire site, this is unlikely.

#### Features P-3 to P-10

Location. Through the central portion of the excavation.

Description. These postholes described a large arc with a maximum diameter of 5 m between P-4 and P-10. Posthole P-3 was somewhat out of alignment, giving the southwest area the appearance of a square corner. The individual holes were between 50 and 130 cm apart, roughly vertical, and filled with intrusive colluvial and aeolian clays. Several also included traces of charcoal, ash or small bone flakes.

#### Postholes P-11 to P-21

Location. Aligned east-west through the south end of the site.

Description. Though the alignment of these holes was a rough, large diameter arc running east-west, there was little orderliness. They varied between 15 and 59 cm in diameter and the longest

regular alignment was composed of only four holes. The depth varied from 6 to 40 cm but most of them appeared to be vertical (Fig. 16). P-11 to P-13 were stuffed with bones, primarily longer ribs, long bones and mandibles, sitting on end.

#### Bone Bed

Location. The bone bed was located south of the largest posthole grouping.

Description. The general appearance of the bone bed was of three layers of bone that increased in thickness to the south and west of the excavation area. There was very little articulated bone and each layer had been burned (Fig. 17).

Further descriptions are included with the bone analysis.

Unlike Level I where all the features were hearths or were hearth related, the features from Level II were of greater variety and offered a wider range of diversity. It seems plausible to divide the site into three or four constituents. To the south was the bison pound, indicated by the bone bed and the north wall of the pound. To the immediate north was the semicircle of postholes that suggests a separate but probably associated pole structure. To the north of that was a butchering area with single hearth, little different from those of Level I. Hearth H-9 and the surrounding postholes could have been another butchering area or part of the either larger structure.

The flat hearth compared very closely with those of the above level. However, the conical hearth appeared to be unique within the site or, for that matter, to any Late Prehistoric site thus far documented on the Northwestern Plains.

The postholes along the north edge of the bone bed strongly suggested the existence of a pound. However, there were no wood remains in any of

the holes. The occurrence of bones, stuffed longitudinally into holes had similarities to the Mulbach site in Alberta, dated at A.D. 680  $\pm$  150; the Stelzer site in South Dakota, dated at A.D. 230  $\pm$  75; and at Saco, Montana (Gruhn 1971:139). Similar situations were also encountered at the Boarding School Bison Drive and Rhinehardt site in Montana (Kehoe 1967:33) and at virtually every other pound site in the Northwestern Plains. Gruhn and Kehoe have both speculated on the origins of these upright bones and have suggested that they were used as anvils; supports for corral poles; or a method of disposing of unwanted bones. In the case of the Estuary site and many other pounds, the close association with other postholes suggests some function related to the corral.

The distribution of bone in relation to the holes strongly supported the impression of a pound structure. The thick bone beds were all to the south of the alignments. To the north, bone concentrations were considerably more sparse and in some areas, non-existent.

The arc of postholes to the north of the "pound" was far less indicative of their nature. However, Frison (1970a:4-5) suggested that stone circles found near the Glenrock Bison Jump in Wyoming were related to shamanistic activity. He cited several ethnographic accounts to support his premise including incidents among Cree (Mandelbaum 1940:190-1), Crow (Medicine Crow 1962:35-8), Assiniboine (Chittenden and Richardson 1905:1028-9), Shoshone (Steward 1938:34) and the Cheyenne (Hoebel 1960:65-6).

Similar enigmatic patterns have been excavated at other pound or jump sites. At the Wahkpa Chu'gn site in Montana, postholes were found in a context which was not explainable as a portion of a pound (Davis and Stallcop 1966:12). They suggested that the remains may have been the remains of a habitation structure but as the feature was not



completely excavated, and as the cultural affiliation was not known, other speculations are possible. Frison (1971:85) gave an extensive description of an arrangement of postholes at the Ruby site, a pound on the Powder River in Wyoming. The site was dated at A.D. 280  $\pm$  135 and was culturally similar to a Besant-Pelican Lake phase mixture. This feature had several attributes in common with the Estuary site, including the lack of artifacts within the circle, the general shape, and the nature of the post moulds. Frison strongly suggested that this feature had a ceremonial function.

The circular shape of the structure at Estuary, combined with the unique hearth and adjacent pits to the south and the total absence of artifacts within the structure does give credence to such a speculation. The existence of similar features, though rare, helps substantiate the speculation.

#### LITHIC ARTIFACTS

##### PROJECTILE POINTS

###### TYPE I

Number. 22 (Fig. 18bb-ww).

Location. Throughout excavation.

Material. 7 local chert, 2 Montana chert, 3 brown chalcedony, 1 local chalcedony, 2 petrified wood, and 7 quartzite.

Description. These points are essentially the same as Type I, Level I. The variable, non-metric attributes are again in the basal shape, shoulders and grinding. In this level 40.9% have straight bases and 27.3% have convex bases. While 59.1% have wider bases than blades, 22.7% are reversed and the remainder are indistinguishable. Nine specimens (40.9%) have basal

grinding. Finally, 52.4% have both shoulders rounded, 28.6% have two sharp shoulders and 19.0% have one of each. Though the samples are small in both levels, it seems that there is a tendency toward a preference for convex bases, followed by concave bases in the upper level and straight followed by concave in the lower level. The blade to base width ratio appears to be relatively stable. There is a greater percentage of points with basal grinding in the lower level.

A single specimen again appears to have one basal juncture worn flat by some abrasion or grinding.

<u>Dimensions.</u> Length:	15.4 - 21.4 mm	mean 19.6 mm
Width:	11.6 - 18.0 mm	mean 14.0 mm
Thickness:	2.0 - 5.0 mm	mean 3.6 mm
Notch length:	1.6 - 5.2 mm	mean 3.5 mm
Notch depth:	.6 - 3.4 mm	mean 1.9 mm

Comparisons. As in Level I, the group fits the general Prairie Side-notched type exceedingly well. Again, if varieties are used, two specimens are similar to the Lewis variety, two resemble Swift Current Fish-Tail, four represent High River and the remainder grade among the generalized type and the Nanton and Tompkins varieties.

## TYPE II

Number. 1 (Fig. 19w).

Location. J28.

Material. Local chert.

Description. This Type II specimen has a flat base and square shoulders with no basal grinding. It is otherwise similar to

the Level I specimen.

Measurements. Length: 16.5 mm  
Width: 11.4 mm  
Thickness: 2.4 mm

### TYPE III

Number. 31 (Fig. 20a-ee).

Location. Throughout site.

Materials. 17 chert, 1 Montana chert, 4 brown chalcedony, 1 local chalcedony, 7 quartzite.

Description. These points are triangular in outline with straight to slightly excurvate blades, sharp tips and a symmetrical outline. The shoulders are obtuse and two-thirds are rounded. The notches are U-shaped and either wide and shallow or roughly squared. The basal edge contracts towards the base or is straight. The basal juncture is obtuse to right angled and can either be rounded or sharp. The bases are all slightly convex to straight and are wider than the blade in all but two specimens.

The material is generally of finer grain than the Type I projectile points. The points are thin for their length which is greater than the Type I specimens on the average. Basal grinding is present on 19 (61.3%) of the points. The bases are also thinned.

Measurements. Length: 17.7 - 26.0 mm mean 22.0 mm  
Width: 12.2 - 16.0 mm mean 14.0 mm  
Thickness: 2.6 - 4.5 mm mean 3.2 mm  
Notch length: 1.6 - 5.3 mm mean 3.3 mm  
Notch depth: .6 - 3.4 mm mean 1.8 mm

Comparisons. This point type agrees very well with the non-metric description of the Avonlea projectile point (Kehoe and McCorquodale 1961a:137-9 and 1961b:179-188). However, the means of the thickness and notch size of the Estuary site sample are considerably larger than that indicated by the above authors.

Comparable specimens have been found in many sites across the Northwestern Plains including Gull Lake (Kehoe 1973), Bakken-Wright (Adams 1975), the Bighorn Canyon (Husted 1969), Long Creek (Wettlaufer 1960), and so on. A more detailed discussion on the relationships of the Avonlea point will follow.

#### TYPE IV

Number. 1 (unique specimen) (Fig. 19y).

Location. K27.

Material. Quartzite.

Description. This specimen is unique in that its base has a pronounced fish-tail. In other respects it is very similar to most Prairie Side-notched points with a triangular outline, slightly excurvate blade and sharp tip. The side-notches are very shallow and long. The base is concave.

The unique aspect is that it has a wider base than blade that extends downward with a definite eared appearance that creates a fish-tail effect.

<u>Dimensions.</u>	Length:	20.6 mm
	Thickness:	4.3 mm
	Notch length:	3.7 mm
	Notch depth:	1.3 mm

Comparisons. It is probably just an exaggerated version of Kehoe's (1966:831) Swift Current Fish-Tail variety of the Prairie Side-notched point. The closest similar specimen is pictured in a short description of the Salisbury site in north-central Montana (Hoy 1973:6, Fig. 2-j). Though the provenience of this point is unknown, other specimens from the site closely resemble Estuary projectile points. Two similar specimens were recovered at Bakken-Wright (Adams 1975:186, Plate 1k, 1) and at the S. S. Burmis site in Alberta (Quigg 1975:93, Plate 1:8) but none with the exaggerated base of this artifact.

#### MISCELLANEOUS

Number. 15.

Location. Throughout the site.

Material. 2 chert, 1 possible Avon chert, 10 quartzite, 1 brown chalcedony, and 1 petrified wood.

Description. These are all broken, undiagnostic fragments that include two tips, nine mid-sections and four base fragments.

#### BIFACES

##### TYPE I

Number. 2 (Fig. 21d, e).

Location. T36, U38.

Material. 1 jasper, 1 quartzite.

Description. Similar to Level I specimens.

Measurements. Width: 43, 18.6 mm  
Thickness: 11.2, 4.1 mm

##### TYPE VI

Number. 3 (Fig. 21s-u).

Location. 032, P32 (2).

Material. 3 petrified wood.

Description. Though only small fragments of two of these specimens were recovered and the third is a poor representative, they appear to be like Level I specimens.

Measurements. Width: 14.8 mm

Thickness: 7.0 mm

#### TYPE VII

Number. 2 (Fig. 22g, h).

Location. W39, W41.

Material. Black chert, petrified wood.

Description. These are similar to Level I specimens.

Measurements. Length: 33.5 mm

Width: 25.8, 21.1 mm

Thickness: 8.4, 7.7 mm

#### TYPE VIII

Number. 1 (unique specimen) (Fig. 22i).

Location. W39.

Description. This rectangular specimen has bifacially retouched, parallel, lateral sides and a bifacially thinned, proximal end. There is secondary retouch on the lateral edges but no evidence of grinding.

Measurements. Width: 21.0 mm

Thickness: 8.3 mm

Comparisons. This specimen appears to have no close affinities to artifacts from other contemporary sites in the region.

## TYPE IX

Number. 4 (Fig. 22j-m).

Location. W39 (1), V41, W46 (2).

Material. 2 petrified wood, 1 jasper, 1 quartzite.

Description. These elongate to ovate bifaces have one convex and one essentially straight lateral edge. One end is rounded while the other is pointed. Both surfaces are fully flaked and there is secondary retouch on the lateral edges. They appear to be slightly asymmetrical and are biconvex or irregular in cross-section.

Measurements. Length: 40.5 mm  
Width: 14.2 - 25.8 mm mean 17.2 mm (3)  
Thickness: 5.0 - 8.4 mm mean 6.3 mm (4)

Comparisons. These specimens appear to be similar to the Type VI artifacts but for two notable differences. They are somewhat wider in relation to length and have a well rounded base. They are most similar to the Type A simple knives from the Bakken-Wright site (Adams 1975:160).

## MISCELLANEOUS

Number. 12.

Location. 6 from the north half and 6 from the south half of the excavation.

Material. 6 quartzite, 2 jasper, 2 petrified wood, 1 chalc-dony, 1 slate.

Description. As in Level I, these specimens all show bifacial retouch on at least one edge, usually a lateral edge. One specimen may be a fragment of a Type VI biface.

## END SCRAPERS

### TYPE I

Number. 9 (Fig. 23g-o).

Location. 7 in the north half and 2 in the south half of the excavation.

Material. 8 chert, 1 quartzite.

Description. Similar to specimens from Level I. The significant difference is that six of the nine specimens are from split pebbles.

<u>Measurements.</u> Length:	19.9 - 35.2 mm	mean 24.8 mm (6)
Width:	17.3 - 30.0 mm	mean 23.3 mm (5)
Thickness:	5.3 - 10.0 mm	mean 7.6 mm (8)
Edge Angle:	50° - 90°	mean 66.7° (9)

## SIDE SCRAPERS AND/OR UNIFACES

### TYPE I

Number. 7 (Fig. 24g-m).

Location. N31, U39, W38, W41 (2), S35 (2).

Material. 4 chert, 3 quartzite.

Description. Similar to Level I. Four specimens have cortex on the dorsal side.

<u>Measurements.</u> Length:	20.0 - 26.0 mm	mean 22.5 mm (4)
Width:	13.3 - 14.6 mm	mean 12.4 mm (3)
Thickness:	3.4 - 6.1 mm	mean 4.8 mm (6)

### TYPE II

Number. 5 (Fig. 24q-u).

Location. T36, V39, W39, W41, U42.

Material. 3 quartzite, 2 chert.



Description. Similar to Level I. All five artifacts are modified on one lateral edge only.

<u>Measurements.</u>	Length:	28.2 - 38.4 mm	mean 32.2 mm
	Width:	6.6 - 17.9 mm	mean 12.4 mm
	Thickness:	2.7 - 10.3 mm	mean 6.4 mm

#### TYPE IV

Number. 4 (Fig. 24v-w).

Location. V38, W40 (3).

Material. 3 chert, 1 quartzite.

Description. All four specimens are on Type I side scraper flakes but have one lateral edge on a dorsal surface retouched to produce a definite concave working edge. Three artifacts are unformed but the fourth appears to be purposely formed into a triangular shape.

<u>Measurements.</u>	Length:	17.6 - 51.0 mm	mean 31.2 mm (3)
	Width:	18.4 - 43.0 mm	mean 32.5 mm (3)
	Thickness:	2.7 - 14.4 mm	mean 9.1 mm (3)

#### TYPE V

Number. 1 (unique specimen) (Fig. 25a).

Location. V39.

Material. Chert.

Description. This primary decortication flake has one edge retouch on the dorsal surface of the right lateral side and distal end. It is unique in that it has battering scars on both ends suggesting preparation by bipolar percussion.

Measurements. Length: 44.4 mm  
Width: 29.2 mm  
Thickness: 10.0 mm

TYPE VI

Number. 32 (Fig. 25b-d).

Location. U39, V40, U40 and V41.

Material. Quartzite.

Description. These perpendicularly aligned ovate flakes have unifacial retouch all along the distal end. The proximal end is thick and unworked, making the artifact backed. They are larger than most unifaces.

PIECE ESQUILLÉE

Number. 1 (Fig. 26e).

Location. Q20.

Description. This flake is very similar in shape and size to the specimens from Level I except that the distal end is broken off so there is no evidence of battering. Therefore its assignment to this artifact group is inferred.

Measurements. Width: 19.0 mm  
Thickness: 8.5 mm

PECKED STONE

Number. 1 (Fig. 27a).

Location. U42.

Description. This split cobble has percussion wear marks on the pointed, undamaged end and on one flat surface just below the break.

## CERAMICS

Number. 2 fragments (Fig. 26f, g).

Location. K27.

Description. As only two fragments were recovered in situ, any description is rudimentary at best.

Both fragments are body fragments of uniform fine paste, and sporadic, finely crushed stone temper. The pieces are no thicker than 6 mm. The outside is light brown-grey and has cord marked grooves (S twist), spaced about 4 mm apart and then smoothed over. The interior is grey, and the surface is smooth with fine brush or hair marks. It also shows indications of charring.

Comparisons. The sample is far too small to suggest any specific comparisons or affinities. However, it seems likely that the ceramics fit with Byrne's (1973:331-5) "Saskatchewan Basin complex". There is no attempt to suggest whether it is an early or late variant.

The most significant aspect of the ceramic sample is that it is definitely associated with Level II, suggesting ceramics were used during that occupation.

## LITHIC INDUSTRY

As in Level I, the lithic inventory is divided into four categories: artifacts, flakes, retouch flakes and fire-broken rock.

The artifacts are manufactured from cherts (39.0%), quartzite (38.2%), chalcedony (10.6%), petrified wood (9.8%) and jasper (3.3%). Of the 47 chert artifacts, 27 (57.4%) are of black chert, 11 (23.4%) are of brown chert and 4 (8.5%) are of grey chert. Of these, split and worked

pebbles represent between 50% and 80% of the total. Three specimens are of Montana chert and one may be of Avon chert. All other chert artifacts are of local or regional origin in the form of glacial gravels. The quartzite artifacts total 46 specimens, all of which are probably local in origin. It is of note that the cobble chopper and the three Type IV unifaces, the four largest artifacts, are all quartzite. Eight (61.5%) of the chalcedony artifacts are of brown chalcedony, generally recognized as an imported material. The other five are of probably local chalcedonies. Of the 11 petrified wood specimens, eight are bifaces and the remainder are projectile points. No petrified wood is unifacially retouched. Finally, four specimens are of jasper.

The flake distribution diverges greatly from the above distribution. From this level, only 13 (9.2%) of the lithics are of chert. At least six of these are from split pebbles. There are 47 (33.3%) quartzite flakes, 7 (5.0%) jasper flakes, 7 (5.0%) flakes of a schistlike material and another 13 (9.2%) are of various poor grade rocks like granite and limestone. The remaining 54 flakes (38.3%) are all of petrified wood. There is no flake that may not be considered as being local in origin. There are also three pebbles of limestone-derived chert and one of quartzite that have been unflaked but were probably intended for use.

Of the 141 flakes recovered, only 32 have fully describable flake characteristics. Of these, 18 are inferred flaking rejects and 14 are smaller flaking rejects or retouch flakes. The former are generally parallel flakes with an unprepared striking platform and percussion scars. The bulbar scars are usually diffuse and small. A smaller number have a perpendicular orientation and any prepared striking platforms are chipped or flaked. The smaller flakes are similar in

character except that more of the striking platforms are prepared by chipping and half are inferred to be pressure flaked.

The retouch flakes recovered from this level are essentially unanalyzed. However, a cursory examination suggests that the wide variety of materials represented, all fall into the range described under the above categories. It appears that the largest proportion of these are of quartzite, followed by black chert and petrified wood. There are minor amounts of jasper, brown chalcedony and various locally derived cherts and chalcedonies.

The 53 fire-broken rocks attributed to Level II are predominantly of quartzite, limestone and granitic rocks, all readily accessible in till outcroppings and river gravels. It is believed that all rocks at the site are intrusive but these local cobbles have probably not been hauled much farther than from the crest of the coulee.

#### BONE TOOLS

The 185 bones or bone fragments classified as bone tools are alike in that each utilizes some fortuitous or deliberate break, occasionally modified by grinding or chipping. That these breaks were used is indicated by polish, smoothing of a rough edge or by striations.

The most commonly used bones are ribs. A total of 103 tools are on rib bones. Some have pointed working edges, some have rounded and some have bladeliike edges. Only 9 specimens indicated deliberate shaping of the bone, all by a grinding procedure. While six bones retain proximal articulating ends, the remainder are medial sections, used on one broken or both broken ends. There seem to be two distinct size ranges, one of less than 15 cm in length and the other greater than 15 cm. The bimodal distribution is around 11 cm and 22 cm.

Long bones, as a group, comprise the second largest group of bone tools. However, there are two entirely different styles of bone tools derived from long bones. The first style consists of 20 tools made from one end of a long bone complete with an articulating end that can be utilized as a handle. The second style consists of 50 long bone shaft fragments with wear marks on one or both ends. Almost all tools are greater than 20 cm in length and bear wear marks similar to those on the rib tools.

There are six scapula fragment tools, four of which have smooth wear surfaces on the posterior border. These specimens include the acromion and a portion of the glenoid area. The other two tools are on fragments of a thin portion of the scapula blade.

There are also four mandible tools, two from the lower portion of the jaw and two from the ramus. One of the latter utilizes the mandibular head as a handle.

Finally there are two unidentified bone fragments that are classified as bone tools.

While there are many different bones or portions of bones of various lengths, shapes, and working edges, most can be reduced to six categories based on wear patterns. These have been divided into four types, one with three varieties.

#### TYPE I

Number. 7 (Fig. 28).

Description. Wear of this type appears as smoothing on a small nodule that extends out from a broken end of bone. This nodule was probably somewhat pointed at one time.

Bones. Four of the tools are on ribs and three are on long

bone fragments. One of the rib pieces has an articulating end.

Comparisons. In actuality, this group may be a variant of Type II. However, they appear to be identical to a group isolated by Frison (1970a:28 and Plate 17ee-hh) at the Glenrock Buffalo Jump in Wyoming except that he says the protruding points are deliberately formed. Similar, deliberately formed tools appear to be represented by Kehoe's (1973:140, Plate 29j-1) "broad-ended" implements. Unfortunately, the implements at Estuary are not as positively identified as deliberately shaped.

#### TYPE IIA

Number. 51 (Fig. 29, 30).

Description. In this group, one end of a bone is broken so that a crude point is formed with no further modification. Wear marks begin right at the tip of this point and often extend 3 or 4 cm along the shaft.

Bones. Of these tools, 25 are formed on ribs. Fifteen of these are of the long variety, one of which has a proximal end. Another 12 are on the end of articulating long bones while nine are on long bone fragments. One of the scapula tools and all four mandible tools have similar breaks and wear patterns.

Comparisons. These are similar to a large number of tools described by Frison (1970a:Fig. 17a-aa, 201-p). They are also represented by Kehoe as awls (1967:57-58), 1973:126-131).

#### TYPE IIB

Number. 7 (Fig. 31).

Description. These are very small variants of the above group-

ing, always occurring on bone splinters, never exceeding 15 cm and always possessing long, tapering points, making them quite sharp. The opposite end is either blunt and thicker or else bipointed.

Bones. Six of the specimens occur on rib fragments while the last is on a scapula.

Comparisons. These again fit within the description of "miniature rib awls" as represented by Kehoe (op. cit.).

#### TYPE IIC

Number. 6 (Fig. 31).

Description. These specimens are similar to Type IIB except that they are still finer, with the tapering point ground to produce a delicate awl or needle-like tool.

Bones. Bone identification is difficult but most appear to be rib bone fragments.

Comparisons. These finely worked artifacts are commonly found in archaeological and ethnographic sources and are almost invariably referred to as bone awls.

#### TYPE III

Number. 25 (Fig. 32, 33).

Description. One end of each of these specimens is broken somewhat squarely with one edge cut to approximate a right angle with the length of bone. This edge is always the farthest extension of the working edge.

Bones. Eleven of the specimens are on long sections of rib and three are on short lengths. Another five are on long bone ends, four of which are distal humeri. Three more are on scapula



fragments and an equal number are on long bone fragments.

Comparisons. These compare well with Kehoe's "endscraper tools" (1967:61 and 1973:137-138).

#### TYPE IV

Number. 22 (Fig. 34).

Description. These tools are small in length but occur primarily on thick but narrow sections of bone. They have one end which is broken or ground to a rounded shape which is then heavily used and often highly polished. A few specimens were used on both ends.

Bones. Seventeen specimens are formed on sections of rib or thoracic vertebrae. They are usually taken from the thickest region and often split. The remaining five samples all occur on small long bone fragments.

Comparisons. These are alternately referred to as knapping tools (Frison 1970a:26-7), flakers (Kehoe 1967:62, 1973:138-9) or polishers (Kehoe 1967:60, 1973:Plate 30j-k). It appears that Kehoe's distinction between flakers and polishers is based largely on the degree of polish observable in the wear patterns. This discrepancy is also noted by Frison (1970:26) who does not differentiate between the two. It is also observable in the specimens from the Estuary site.

#### MISCELLANEOUS

Number. 3.

Description. Two of these bones have one end crudely broken to produce a rough end of several jagged points of varying lengths. On these tools, the longer, more exposed points are

all worn. While one of these tools is on a rib section, the other is on the end of a long bone.

The third bone is a nearly complete length of rib which shows a high degree of polish along the entire length of the medial surface.

Comparisons. Neither type of wear is described in similar reports.

#### BISON REMAINS

Skull. The only large skull fragments recovered in situ were five horn cores attached to sections of frontal bones, one partial occipital, two articulating nasal bones, a zygomatic arch, 35 maxilla fragments, 13 ear ossicles, 26 hyoid bones, and 99 miscellaneous fragments. While 26 pieces were of the posterior sections, including the molars and premolars, only seven were from the anterior area. There were no complete maxillas.

The mandible fragments, alternatively, had highly uniform breakage patterns. Two complete specimens were both from the right side. Of the 34 ramus sections, 17 were split down the ramus itself leaving 12 mandibular condyles and six coronoid processes. Together, the ramus fragments totalled 27 separate right mandibles and seven left. Another 50 pieces of the molar-premolar area were recovered but only seven of these were complete through the molars and premolars. All other pieces were split longitudinally, below or through the root section of the teeth. Many were also broken down between the teeth. These pieces were divided into at least 8 right mandibles and 10 left. There were 16 fragments anterior to the first premolar, but only one still had a fused symphysis menti and few still had intact incisors. Ten of these were left and six

were right. There were four left mandibles complete but for the anterior section and the mandibular angle area which two were missing. Finally five mandibular angles were represented, three of which were left sides. This gave a total minimum inventory of 29 right and 11 left mandibles.

A total of 13 mandibles were examined for aging purposes on the basis of tooth eruption and wear, using Frison and Reher (1970:46-50) and Fuller (1959:342-4). The specimens were identified in half year intervals up to 3.5 years, then 4-5 years and mature. There were nine of the first group, three of the second and seven of the last. To determine seasonality, only the immature mandibles were diagnostic. Five of these were identified as an even year while four were at half a year. This strongly suggested that the actual season was on the quarter year. Given a late spring birth, the season of the jump would have had to be either late summer or late winter.

Butchering marks on the skull fragments were not evident but several mandible fragments did have scratch marks. Of the 19 specimens so marked, eight were along the posterior edges of the ramus, seven were on the bone surfaces just below the molar region, and two were on the outer surfaces, anterior to the first premolar. One specimen had scratches across the lateral surface of the ramus and one had them posterior to the third molar.

Vertebrae. Identifiable vertebral elements included 11 atlases, 26 axes, 63 cervical vertebrae, 97 thoracic vertebrae, 6 lumbar vertebrae, a first sacral vertebra, a fused second and third sacral vertebra and 37 os coxae. There were also a large quantity of fragments.

A great many of the vertebral elements had various processes broken.

off but in most cases a butchering origin was impossible to determine. However, certain butchering aspects were identifiable on the thoracic region. All but three specimens had the spinous process broken off. Of these, 29.8% were removed between one-quarter and one-half way up the shaft and 70.2% were severed right at the base of the shaft. Of the 89 spinous process fragments, eight had scratch marks on the lateral surfaces. Breakage marks on the spines and vertebrae appeared to be a result of percussion battering.

It should be noted that there were six excavated sections of articulated vertebrae. Three of these were the first five to eight thoracic vertebrae, one was an articulated section of thoracic and cervical vertebrae; and the remaining two were articulating thoracic and cervical vertebrae separated from each other by 30 cm. All the articulating thoracic sections had the ribs and spinous processes broken evenly along the row.

Ribs. Of the 674 rib fragments (excluding the rib tools) inventoried, only seven were complete. The remainder were listed by the length of piece and the section represented. The first category, greater than 30 cm, two were distal pieces, 20 were medial and six were proximal. There were 52 medial and 41 proximal lengths between 15 and 30 cm. The pieces less than 15 cm long included 159 medial fragments and 98 proximal ends. There were also 289 fragments split longitudinally, nearly all of them medial sections, less than 20 cm long.

The 37 specimens with butchering scratches grouped into 34 (91.9%) with transverse marks and 3 with parallel marks. Twenty-four (64.9%) were on a lateral surface of the rib and the remaining 13 were on the medial surface. Fracture marks on the ends of the ribs were also

indicative of butchering. At least 258 of a possible 667 (38.7%) showed purposeful fracturing on one end while only 90 of a possible 501 (18%) had purposeful breaking on both ends.

From a sample of 100 split fragments, 58 were identified as split in butchering as opposed to weathering or subsequent excavation and 61 had fracture marks on one or both ends. Four had transverse butcher marks on the lateral edge and eight had similar marks on the medial side. Only 11 fragments were proximal ends.

Forelimbs. There were 36 separate scapulas identified in the inventory, of which 20 were right side. Though none were totally complete, seven bore only minor damage to the distal end of the blade. Sixteen specimens were smashed at the beginning of the blade, two had the glenoid and tuber sections removed, one was nothing more than a glenoid and three were broken across the neck, above the acromion. The remaining specimens were of various fragments around the glenoid or acromion areas. One specimen showed butcher scars on the posterior surface below the glenoid. One larger bone was articulated to a proximal humerus.

There were two complete right humeri, four proximal ends and 18 distal ends. Three of the proximal and eight of the distal pieces were right members. All of the proximal and 11 distal bones were fractured as close to the head as was possible. On several of the fragments, if any of the shaft remained intact, a large piece was hacked out to expose the entire marrow area. Two of the distal fragments had butcher scars on the bases, one laterally and one medially.

Radius bones included one complete left, 11 left distal, seven right distal, 12 right proximal and 11 left proximal. Butchering practices were very similar to the humeri. Proximal ends were broken close to the head or split along the shaft to expose the marrow. Twelve distal

ends were broken between one-quarter and one-half way up the shaft and the remainder were unfused epiphyses.

Of the 13 left and 10 right ulnas, seven had missing epiphyses on the olecranon. Eleven specimens had the shaft broken near the proximal end while 12 were removed closer to the juncture with the radius. All appeared to have been deliberately split from the radius and no articulated radius-ulnas were found. Four ulnas had butcher marks, all of them toward the distal end of the olecranon, on the anterior or posterior edges.

The sixteen complete metacarpals were evenly distributed by side. Five of the nine distal ends and seven of the 16 proximal ends were left side. Again, there was little or no shaft remaining on two-thirds of the bones. Two of the four metacarpals displayed butcher marks over the length of the anterior surface while the other two exhibited similar marks on the distal posterior surface.

There were also 27 ulnar carpals, 26 radial carpals, 22 intermediate carpals, 27 second and third carpals and 16 fourth carpals.

Hindlimbs. Only 17 fragments of pelvis were found throughout the excavation. Three consisted of little more than an acetabulum; two included most of the pubis; and two included large portions of the illium and ischium. The remainder were fragments of illium and ischium.

One left distal femur, broken at the shaft base, was the total femur inventory. There were 13 patellas recovered.

Tibial elements included one complete left, two proximal left, eight distal left and 11 distal right. Of these, four distal pieces were unfused epiphyses and 13 fragments contained little or no shaft. The four remaining distal ends had portions of the shaft removed to expose

the interior. The single complete specimen had butcher marks on the mid-lateral surface while the two right distal pieces displayed scars at the base of the shaft.

The 29 metatarsals included two complete, seven distal and nine proximal right with four distal and seven proximal left specimens. Three of the distal bones were fractured at the proximal end of the shaft, one at the distal end and the rest near the middle. Nine of the proximal specimens had breaks at that end while the remainder were in the centre. Only two bones had butcher marks on the shaft.

The diagnostic bone inventory was completed by 35 fused central tarsals, 26 tibial tarsals, 20 fourth tarsals, 21 fibular tarsals, 17 lateral malleoli, and an undifferentiated 84 first phalanges, 91 second phalanges and 76 third phalanges. A number of the metapodial and podial elements from both front and hind limbs were articulated.

Foetal Bison. A total of nine foetal fragments were found in Level II from five different areas. Of these, the only specimens that identification was possible on were two scapulas that were probably bison. Four of the other foetal bones were associated with one of the scapulas. All but one of the bones was encountered out of the pound.

Though the sample was small, the very existence of formed foetal bone helps to determine seasonality. If the choice of season is limited to late summer or late winter on the basis of tooth eruption, the existence of foetal bones argues for a late winter kill for Level II. If this season is expanded to take in the normal range of the birth season, the kill would probably have been conducted between early February and late April. This seasonality applies only to Level II. All other components are unanalyzed.

#### NON-BISON REMAINS

The non-bison remains were extremely unusual. The largest concentration was of at least seven ground squirrel (Citellus tridecem) individuals, all found around hearth H-10. There was also a complete left limb from a canid (Canis lupus?) and a second left scapula from another canid. Other bones included a left metatarsal from a fox (Vulpes fulva?), a bird radius mid-section (Aves sp.?) and two ribs that were suggested as fox and rabbit. Finally, there were a couple of fragments of shell, probably Unio sp.

#### INTERPRETATION

The features from this level were considerably more diversified and at the same time more integrated than Level I. Postholes P-11 to P-21 and the bone bed were integrated into a bison pound. Postholes P-3 to P-10 and perhaps P-1 and P-2 and hearth H-9 were part of a second structure. Hearth H-10 and its associated boulder created a third activity area while the charcoal concentrations were probably scattered remains from the various fires.

The excavated artifacts included at least 69 projectile points, 27 unifaces, 21 bifaces, a single pièce esquillée, a pounder, a couple of ceramic fragments and 118 bone tools. The projectile points were essentially of two types - Prairie Side-notched and Avonlea although a couple of aberrant specimens were also noted. The bifaces were composed of three types of formed bifaces and three more generalized, unformed types. There was one group of endscrapers and sidescrapers in five types. The bone tools, again, were divided into four major groups, based on the shape of the working edge.

The faunal material was almost entirely bison, like Level I. The



minimum count of the excavated material from Level II alone was 29 individuals but the actual number could be as high as 150. This did not include remains from the lower beds which were too fragile to remove.

Again, remains were fragmentary but there was a larger collection of torso bones. There were still larger numbers of small, undiagnostic bones. The non-bison remains of significance were large canid, a large concentration of ground squirrel bones and some shell fragments.

The distribution of various elements was not as uniform as it was in Level I. The features, being more diverse and larger in nature, tended to be determining factors in the distribution of artifacts. The bone was most heavily concentrated south of the postholes and in pit W46. The projectile points were concentrated with the bone, south of the postholes. Other lithic tools were more or less evenly distributed but with slightly higher concentrations in the area around H-10. The interior of the circular structure (P-3 to P-10) was virtually void of lithic or bone material. The collection of rodent bones was found south of H-10.

#### ACTIVITIES

The activities of this level were much easier to interpret than those of Level I. Furthermore, in most cases, the data was more plentiful, permitting a greater depth of study. The general nature of the level as a bison capturing and processing area enabled a neater, more detailed study to be undertaken.

Bison capturing. The bison were driven into the coulee and contained in some form of a pound. As only one wall of this pound was excavated, it was difficult to determine whether or not it was a corral type structure or merely walls of poles blocking possible exits. Under either circumstance, a blockade was used to impede the animals. This

structure was constructed of poles, probably obtained from deeper in the coulee. Some were inserted into irregularly spaced, prepared holes and fixed into place. They were then stabilized with earth and, occasionally, bones pushed vertically into the holes. The spaces between these poles were likely filled with brush and horizontally laid limbs of trees.

There were no obvious signs of drive lanes on the prairie above the pound as much of the area had been under cultivation at some time in the past. Originally, it was believed that the drive lanes extended to the east as there seemed to be larger rock piles from cultivation in that region. However, after a survey along the lower Red Deer River in 1975 a noted regularity in drive lane patterns altered this opinion.

Over the course of that summer, a total of 14 drive lane complexes were recorded. Almost invariably, these followed the same basic pattern. They were aligned from the open prairie, directly into the end of a coulee or the end of a small, transverse drainage channel. Whenever tested, there was never a sign of a bison bone bed found just below these drive lanes. It was then interpreted that the gentle downward slope of the coulee itself was used as the final funnelling process (Adams 1976:98-99). Such a process could have been easily adapted to the situation at Ef0k-16.

Once in the pound, the bison were dispatched by bow and arrow and butchering was begun right there.

The fact that the site was used three different times helped explain several features of the site. First, the confusing, almost random nature of the postholes was easily explained as the reconstruction and refortifying of the pound. This would also explain the vertical bones

stuffed into the postholes. Bones lying on the surface could have been used as wedges to support old, loosened poles or new poles being set into place.

There was also a hint that there was a preconceived notion that the site would be reused. In the archaeological record, burning the bone bed of a bison drive was neither an uncommon nor a universal practice, suggesting some particular purpose. At Estuary, the stratigraphic record indicated that the pound was used repeatedly within a few years while the buildup of intercomponent alluvium indicated at least one spring runoff. If there was foreknowledge that Estuary would be used again in a year or two, burning the leftover carcasses would have helped alleviate the stench and reduce the intervening period of disuse. The effect of the stench of a bison drive has been documented in historic context (Hind 1860:354). It has also been suggested by Frison (1970a:6) that the stench and decay may have been so bad that the users were forced to alternate between nearby sites.

Butchering processes. In the most general terms, the butchering process began right in the pound where the hide was removed and the bison sectioned. Large portions of the animals were removed to other activity localities while the remaining sections had the meat removed and were then broken for marrow. The bison was efficiently butchered to retrieve tongues, brains, marrow, skins and probably internal organs.

In more specific terms, the obvious first step was hide removal. Score marks on the metatarsals suggest that encircling cuts were made to remove the leg hide and tendons. However, there were no indications of whether the main cut was on back, side or belly. The scarcity of caudal vertebrae has been explained by Frison (1970a:11) as having resulted

from the use of the tail as a handle to remove the skin.

The skull fragments were few and badly smashed which indicated two things. First, a large number of the skulls were removed from the site. It could be assumed that the mandibles were removed first but whether the skull itself was later butchered or used in some other manner remains speculative. The few that were left were badly smashed, apparently from the top, for removal of the brain. The horn cores had no remaining horn which could have resulted from its removal for additional marrow or for the retrieval of the horn itself. Alternatively, horn and hoof material is very susceptible to destruction from insects and natural decay.

Removal of the tongue and jaw was certainly conducted right at the site. This was accomplished by turning the skull on its side and smashing through the ramus to break off the condyle and coronoid process. Butcher scars along the posterior border of the ramus supported the indication of severing the jaw at that point. Further breaking of the jaws may have been for the extraction of marrow or removal of small meat scraps. Frison (1970a:11) suggested that the butcher marks below the first premolar were indicative of part of the skinning process as there were no muscles in that region.

The foot bones were also removed at the site though points of removal are quite diverse. It appeared that the muscles were cut to the bone, stripped back and then the bone was shattered. This either occurred at the distal end of the lower long bone or along the shaft of metapodial. It did not appear that there was an attempt to cut through the gristle and tendons of the joints. Many of the distal long bones and broken metapodials were then split open to reveal the entire central cavity,

perhaps for the extraction of marrow. Bone segments with articulating phalanges or tarsal/carpal bones were often left intact and discarded.

There appeared to be two methods of butchering the front legs. Either method required that the whole front quarter be removed first. How this was done is speculative but it is possible that the leg was pulled out, perhaps with the use of bone tools. Muscles would have been severed inside the leg up to the articulating tuberosities which would have been removed by chopping and smashing or by pulling it from its socket. The process may have been continued to include part or all of the scapula. Alternatively, the lateral tuberosity could have been extracted first, breaking the scapula in the process. The leg would have then been lifted to remove the medial tuberosity. The surrounding muscles would have been stripped off and the leg removed. At this point the alternate methods were introduced. Judging by the remains found, about half of the specimens were hauled to other activity areas. The remainder had the meat stripped, the humerus and radius shafts broken and the ulna broken off.

The hind quarters were completely removed. With the exception of a couple of bones, there were practically no remains of any bones from the first lumbar vertebra to the proximal tibia, inclusive. The notable anomaly was the presence of patellas. Apparently the whole hind quarters were removed to a different location for further dissection.

The ribs and vertebrae had butchering marks very similar to those described by Frison (1970a:19). Like Glenrock, the primary rib pieces included short proximal sections, long pieces with a missing distal end, fragments with both ends missing and no sternums or distal fragments. From this he postulated that one side was broken off close to the vertebral column to gain entrance to the body cavity. Then ribs 6 to 9

were removed as a unit. The body was then emptied and turned. The ribs were then removed as a unit and the sternal portion removed and carried off. At Estuary, the remaining meatless ribs were often fragmented for tools or further processing.

The removal of the lumbar vertebrae and sacrum areas may have occurred at this point rather than with the hind quarters. The dorsal spines were broken evenly for the removal of the hump and finally the vertebral column was separated, usually at the atlas, lower cervical area and mid-thoracic area.

The tools used throughout the process had several unique features. The lithic tools were primarily small, sharp bifaces, small scrapers and larger unifaces that could have doubled as scrapers and choppers though they were not particularly sharp. There was a notable absence of large pounding tools, anvil stones, choppers and large bifaces. This suggested that either these tools were removed with the unbutchered carcasses or that the heavy duty work was conducted with bone tools.

The bone tool assemblage appeared to comprise the major portion of tools at the site. Though some tool groups such as the Type IIC "awls" appeared to be created for a specific purpose, the remainder were probably far more generalized in function. On the other hand, Frison's statement (1970a:30) that most tools represented a wide variation within a single type, did not fully describe the situation either. As he suggested, most tools were worn in a similar pattern, perpendicular from one end. However, formal and functional descriptions could vary considerably and still have similar wear patterns.

At Estuary, it seemed reasonable to conclude that the Level II tools represented artifacts used for the most part in the primary butchering

and sectioning of the animal. Secondary uses would have included tools used to remove meat from the bone, hide processing, and stone tool sharpening. If these conclusions were accurate, further speculations on the use of the various recorded types was also possible.

Type I and II artifacts were similar in that they were pointed. Depending upon size and serviceability these would have been useful as gouges, tools to separate bones, awls, wedges, punches and pegs to hold down a hide while it was being worked on. The Type III tools could have been used as scrapers, fleshers, gouges and wedges. Type IV tools had to be separated on the basis of wear. The rougher specimens may have represented knapping tools while the smoothed specimens had to supply some kind of polishing function.

Food preparation. The activity around H-10 was inferred to be food preparation. The large boulder may have been an anvil stone (Frison 1967a:13, Plate 28) on which several bones were butchered including distal humeri, metapodials, vertebrae and a mandible. Sections of these were then cooked over the fire, either for immediate consumption or for some form of preservation. The fact that these bones were found in the fire, rather than around it, suggested that the waste products were returned to the flames. The area around the hearth also had the unexplained rodent skeletons and the largest concentration of flaking detritus. This area may have served as a centre for food and warmth while work was in progress.

Ceremonial activity. Two features at the site were strongly indicative of ceremonial activity. The first was the semicircular arrangement of postholes. It had no observable living floor and almost no artifacts or garbage inside it. Unfortunately the interior was not fully excavated

but the sections that were removed yielded no evidence of internal features. The lack of bone indicated that it was probably not a functional part of the pound while its location and missing living floor precluded its use as a habitation area. By a process of elimination, this left a religious structure. As previously stated, such structures were not uncommon in the historic and ethnographic accounts and have been recorded. Frison (1970a:41-2 and 1971:85), further, tried to make a case for the ceremonial use of certain structures at the Glenrock Buffalo Jump and at the Ruby site.

The second enigmatic feature was H-9. This hearth was totally unlike any other hearth at the site in both shape and size. It was even unlike anything that was described in the literature for the region. Furthermore, there was no doubt that it was a hearth with constituent material very similar to the other hearths in the area. This, along with its location adjacent to the above feature, argued for its inclusion into a ceremonial complex.

The only difficulty with this interpretation is that I have been unable to determine what form the complex took. The ethnographic accounts stated that the ceremonial structure was a tipi. Though tipis were probably in use at the time of the site's use, the excavated remains did not indicate that form of structure. Tipi poles were not generally rooted and there was no evidence of peg holes or support rocks for the cover. Further, the structure made a poor figure of a circle. The remains were also quite inappropriate for an earth lodge.

Lithic industry. The lithic industry was virtually identical to that of Level I except that there was less evidence. There were few primary decortication but several flaking rejects of quartzite. Local



chert flakes came from pebbles, sometimes manufactured at the site. Rarer materials, both imported and local, were lacking in the reject flakes but were represented among the retouch flakes.

## LEVEL IIB

The few artifacts associated with Level IIB are included in the analysis for Level II. However, a separate listing of artifacts and their location is provided below.

### ARTIFACTS

There are only eight artifacts that can be attributed to Level IIB. Three of these are projectile points, all from pit L27. Two of the points are of Type I and one is of Type III. Two Type I endscrapers come from pits V38 and V39. There is a Type II sidescraper from W39, a Type IV sidescraper from V39, and a Type VI sidescraper from U39.

### LITHIC INDUSTRY

Of the eight artifacts, five are of chert, one is petrified wood and two are quartzite. The two endscrapers are both manufactured on modified black chert pebbles. All the materials are probably local in origin.

The 15 flakes are all small to medium in size. Five are of a limestone-like material, three are of chert and the remainder are coarse granite.

In this level, the few retouch flakes are all counted. Of the 48 retouch flakes, 24 are quartzite, 15 are black chert, 8 are other cherts and one is jasper. There is no petrified wood represented.

### INTERPRETATION

The interpretation of the utilization of this level, based on the fragments of remaining cultural material, is essentially identical to the interpretation of Level II. It appears that Level IIB and probably

an even more obscure Level IIC are both earlier representations of use of the same pounding structure and its associated activity areas. Stratigraphy suggests that all three occupations occurred within a limited time span - probably less than ten years.

## MISCELLANEOUS MATERIALS

The fact that certain pits had poor provenience data and the existence of other collections, necessitated the following separate listing of artifacts and features. The following section describes and attempts to assign the various artifacts and features with ambiguous context to their respective levels.

### FEATURES

#### Hearth H-7

Location. L30, M30, M31.

Description. H-7 appeared as a crescent-shaped hearth as the southwest quadrant had been eroded away prior to excavation. It was probably ovular in shape and about 130 cm long on its greater, north-south axis. It was virtually flat and contained charcoal, ash and burnt bone chips.

Provenience. Probably Level I as it was confined within the border of the pound and would have been near the top of Level II if attributed to it.

#### Hearth H-8

Location. M31, N31, N30.

Description. Like the adjacent H-7, this hearth was disturbed all along the south edge. The remaining portion is tear-drop shaped and 105 cm long. It contained the usual ash, bone chips and charcoal. The hearth itself was flat. It was possible that hearths H-7 and H-8 were actually part of a very large firepit of some nature.

Provenience. Probably Level I for the same reasoning that ascribed H-7 to that level.

#### Feature C-5

Location. L29, L30.

Description. This series of eight small charcoal concentrations were probably spread out from H-7. The largest was 40 cm long while the smallest was only 8 cm. They were irregularly shaped and concentrated along the east edge of the hearth.

Provenience. Probably Level I.

### LITHIC ARTIFACTS

#### PROJECTILE POINTS

The unassigned projectile points are grouped into two collections. The first group consists of points excavated from sections of pits where the provenience is dubious. The second group is represented by the diagnostic projectile points collected by Charles Nagel and Norman Nagel. These two groupings are being treated separately.

#### TYPE I

Number. 24 (Fig. 19a-u).

Location. All are from the south edge of the excavation except for one specimen from R50.

Material. 6 black chert, 7 local chert, 8 quartzite, 2 petrified wood, 1 chalcedony.

Description. These specimens conform to Type I characteristics.

#### TYPE III

Number. 9 (Fig. 20ff-11).

Location. One from R50, remainder are from the south rim of the excavation.

Material. 2 black chert, 2 local chert, 3 quartzite, 1 chalcedony, 1 petrified wood.

Description. These specimens conform to Type III characteristics.

#### TYPE V

Number. 1 (unique specimen) (Fig. 19z).

Location. R33.

Material. Brown chalcedony.

Description. This specimen has a straight blade, U-shaped notches, and a convex base that is wider than the blade. The unique aspect of this point is that the notches are set low on the blade and angle down to the basal juncture leaving no basal edge. This gives the impression of corner notching. The base is thinned, but unground. The blade is symmetrical, the shoulders right angled and the cross-section is biconvex.

Comparisons. Of all the side-notched varieties, this specimen is most like the High River Corner-notched but it is larger, finer worked, and the base is wider than the blade. In fact, when compared with a wider range of artifacts it is most similar to Pelican Lake points (Wettlaufer 1955).

#### MISCELLANEOUS

Number. 9.

Location. South edge of the excavation.

Material. 5 quartzite, 1 black chert, 2 local chert, 1 jasper.

Description. These specimens are too fragmentary for analysis.

Though it is difficult to provide proveniences for these points, the presence of the Avonlea (Type III) points strongly suggests that many

of these specimens belong to Level II.

The second series of points almost all come from the disturbed area to the immediate south of the excavation within the confines of the pound. In 1971 they were sent to Calgary along with the excavated points. Jim Rogers, utilizing Reeves' (1970c) "Working Papers in the Metric and Non-Metric Classification of Chipped Stone Tools", made 29 measurements on each of these points. They were then compared on a basis of gross metric configurations and 176 of 245 points were described as Avonlea. The remainder were termed Prairie Side-notched. Unfortunately no non-metric analysis was conducted before the points had to be returned to their owners.

An examination of the colour photographs of the points did reveal some additional information. A tentative identification, based on outline shape, suggests that 158 (71.2%) of the 222 points are Prairie Side-notched (Type I). Another 58 (26.1%) are Avonlea (Type III); 2 (.9%) are Triangular (Type II); 1 (.5%) is Type IV and 3 (1.4%) are Type V.

The material types are also approximated by colour, texture and translucence. It is suggested that 101 (45.5%) are black chert; 30 (13.5%) are local cherts; 66 (29.7%) are quartzite; 14 (6.3%) are petrified wood; 5 (2.3%) are brown chalcedony; 3 (1.4%) are local chalcedony and 3 (1.4%) may be imported chert. Some of these material assignments may be erroneous but the general trends observable by the percentages are probably quite valid.

#### BIFACES

The 17 bifaces represented are all from the local collections previously mentioned and come from the same region of the site.

#### TYPE VI

Number. 3 (Fig. 21s-u).

Material. 1 chert, 1 brown chalcedony, 1 petrified wood.

Description. These specimens conform to the type description.

The chert biface is the only complete example from the site and is the basis for comparison upon which other specimens are assigned to this type.

Measurements. Length: 44.5 mm  
Width: 12.8, 11.2 mm  
Thickness: 8.0, 5.2, 4.4 mm

#### TYPE IX

Number. 7 (Fig. 22n-p).

Material. 5 petrified wood, 2 quartzite.

Description. Though none of these specimens is complete, all appear to be similar to Type IX artifacts of Level II.

Measurements. Length: 28.4 mm  
Width: 14.9 - 15.9 mm mean 15.4 mm (3)  
Thickness: 4.3 - 8.5 mm mean 6.4 mm (7)

#### TYPE X

Number. 1 (unique specimen) (Fig. 22q).

Material. Quartzite.

Description. This is a small, bipointed, essentially ovate biface. One edge is very convex while the other is almost straight. The straighter edge has a unifacially worked concavity in the distal half of the artifact. The blade has complete primary and secondary retouch on both surfaces, a slight scallop to the edge sinuosity and one relatively sharp point.



Measurements. Length: 46.0 mm  
Width: 21.4 mm  
Thickness: 6.2 mm

Comparisons. In shape, it most resembles Kehoe's "bipointed ovoid knife" which he suggests has Late Woodland affiliations (Kehoe 1973:106). Other specimens are located at Glenrock Buffalo Jump (Frison 1970:Fig. 23o), and at Occupation II of the Magnus site in the Bighorn Basin (Husted 1969:Plate 18e, f).

#### ENDSCRAPER

##### TYPE III

Number. 1 (unique specimen) (Fig. 23q).

Material. Chert.

Description. This is a highly unique endscraper. It is on a long, triangular flake with the wide, steep, distal end flaked into an endscraper. However, lateral flaking extends back to the proximal end to produce a keeled back and steep, lateral edges for use as a sidescraper. The proximal end, though almost pointed, is also unifacially flaked.

Measurements. Length: 59.6 mm  
Width: 22.7 mm  
Thickness: 10.9 mm  
Edge Angle: 80°

#### PECKED COBBLES

Number. 2 (Fig. 27b, c).

Location. Surface.

Material. Quartzite.

Description. Both specimens are quartzite cobbles, broken

unifacially through the middle and displaying pock marks from use as a percussion instrument on the undamaged end. Further, one specimen is similar to the Level II artifact in that a second area of percussion is evidenced on two flat sides near the break.

It is speculated that somewhere between 75% and 90% of the above described material, along with an additional 38 projectile point fragments, 6 biface fragments, 2 small unifaces, 2 small cores and 64 flakes all come from the Level II components.

#### CERAMICS

Number. 3 fragments (Fig. 26h-j).

Location. One is from an inconclusive provenience in square N31 while the other two are backfill discoveries.

Description. Specimen 1. This piece has a blocky paste and large amount of angular, crushed rock temper varying between 1 and 4.5 mm in length. It is 7 mm thick, tan to grey on the exterior and grey on the interior. It is a rim sherd with no lip thickening or decoration. It appears to be slightly concave below the lip. Both surfaces are smooth as is the top of the lip.

Specimen 2 has a laminated paste and sparse temper barely exceeding 1 mm in thickness. The piece is 9 mm thick, grey on the exterior and black on the interior. Though very small, it may have a smoothed over, cord-marked exterior.

Specimen 3 is similar to the second but is only 6 mm in diameter and has a tan exterior. Both of the last two pieces could be similar to the ceramic fragments from Level II but the first specimen seems to be unique in paste and temper.

## BONE TOOLS

### TYPE I

Number. 1 (Fig. 28).

Bone. Medial section of rib.

### TYPE IIA

Number. 9 (Fig. 29, 30).

Bones. There are 2 on long medial rib sections, 2 on short medial rib sections, 2 on short proximal rib sections, 2 on long bones with articulating ends and one on a long bone fragment.

### TYPE IIB

Number. 1 (Fig. 31).

Bone. This specimen is on a small rib fragment.

### TYPE III

Number. 2 (Fig. 32, 33).

Bones. Both are on unidentifiable long bone shaft fragments.

### TYPE IV

Number. 7 (Fig. 34).

Bones. Four appear to be on rib or spinous process fragments, while the remainder are on unidentifiable long bone fragments.

All of these bones were excavated from the south section of the pit.

It is assumed that, like the stone artifacts, 75% and 90% are from Level II.

## COMPARISONS

The purpose of this section is to fix this site in place, time and function. To do this, four stages of comparison are needed. First, the two levels must be compared against each other. Between them, certain key attributes in terms of change and constancy can be defined. These attributes can then act as indicators for the succeeding stages. These stages will involve comparisons with alternate sites of the same activity, other contemporaneous sites, and sites of similar phases. In the course of this process, a hard look will be given to the terminal Avonlea Phase.

### INTRASITE COMPARISONS

The two occupations are more similar than dissimilar. They have similar gross tool categories, features, subsistence base, lithic technologies, environmental utilization and contextual configurations. If the pound feature is removed from Level II, the remains would be very much the same. Given this and knowing that Level II is a combination of bison pound and butchering area, the reasonable conclusion is that Level I is also a butchering area rather than a campsite. This conclusion appears to be substantiated on a closer examination. The butchered bone remains, bone tool types, stone tool types, hearth constituents and lithic materials all overlap significantly with their counterparts in the lower level.

What then are the differences? In overall appearance, it seems that the distance from the actual bison trapping centre provides the significant difference. It can account for the higher bone count and ratio of

projectile points to bifaces and scrapers in Level II. It may also suggest reasons for the greater number of hearths and the refuse pits in Level I. It might equally be responsible for the higher flake density and lower bone tool density in the same level.

The simple explanation for this is that the closer one is to the actual kill area, the more restricted the activities are, because the working space becomes more of a premium. Within the kill area, one would be able to accomplish little more than skinning the animals and removing large chunks of meat. The immediate periphery would be utilized through an extension of the activities conducted within the pound and with specific designated functions. These functions would include the ceremonial structure and perhaps the separation and stacking of various butchered units. The farther removed a worker is from the centre of the kill, the more freedom there is (in terms of space) in which to conduct a wide variety of supplementary activities.

Typologically, there are certain small differences, some of which may be of immense importance. First, Level I has only Prairie Side-notched variants of projectile points while Level II includes both Avonlea and Prairie Side-notched. Second, excluding individual specimens, Level I lacks Type IX bifaces, Type IV sidescrapers, Type VI sidescrapers, ceramics, cobble tools and Type I bone tools. Level I has no Type VII bifaces. As a further distinction, while Level II bone tools concentrate on ribs, Level I bone tools concentrate on long bone fragments to the point that there are no Type I (found only on Level II ribs), no Type III on ribs and only two Type IV tools on ribs. While some of these differences may indicate nothing more than a selection process in excavation, others may be significant in a study of cultural continuity.

## NORTHWESTERN PLAINS COMPARISONS

Though preliminary comparisons have already been undertaken with individual artifact types, it seems necessary to establish the two components of this site into perspective in Northwestern Plains prehistory. In the following comparisons study is restricted to an examination of sites that fit within specific parameters. Therefore, only sites located on the Northwestern Plains, affiliated with Avonlea and Old Woman's phases and occurring sometime between A.D. 400 and A.D. 1100 (Fig. 8) are compared. Attention is also given to some external bison killing sites.

The nearest excavated site to Estuary is the Gull Lake site (Kehoe 1973). This site, located on the rim of an escarpment of the Missouri Coteau in Saskatchewan, is interpreted as a multi-component pound site. It has been partially excavated by a number of individuals but the primary work has fallen to T. Kehoe in 1960 and 1963. A total of 52 stratigraphic layers are recorded of which virtually all of the upper 32 are culture bearing. These levels include representation of Avonlea, Prairie and Plains Side-notched complexes.

The actual distribution of projectile point types is confused somewhat by Kehoe's seemingly overambitious variety designation but certain generalizations are possible. The Gull Lake variety of Avonlea point is by far the most numerous of that type, and occurs in Layers 31c to 26 (larger number is lower). Level 31a provides one of the earliest dates for the Avonlea phase at A.D.  $210 \pm 60$  (S255). The Carmichael Wide-eared variety is found in Layers 29a to 24 and the Timber Ridge variety is located only in Layers 27 and 26. The most recent level of exclusively Avonlea points is Layer 26 which has a radiocarbon date of

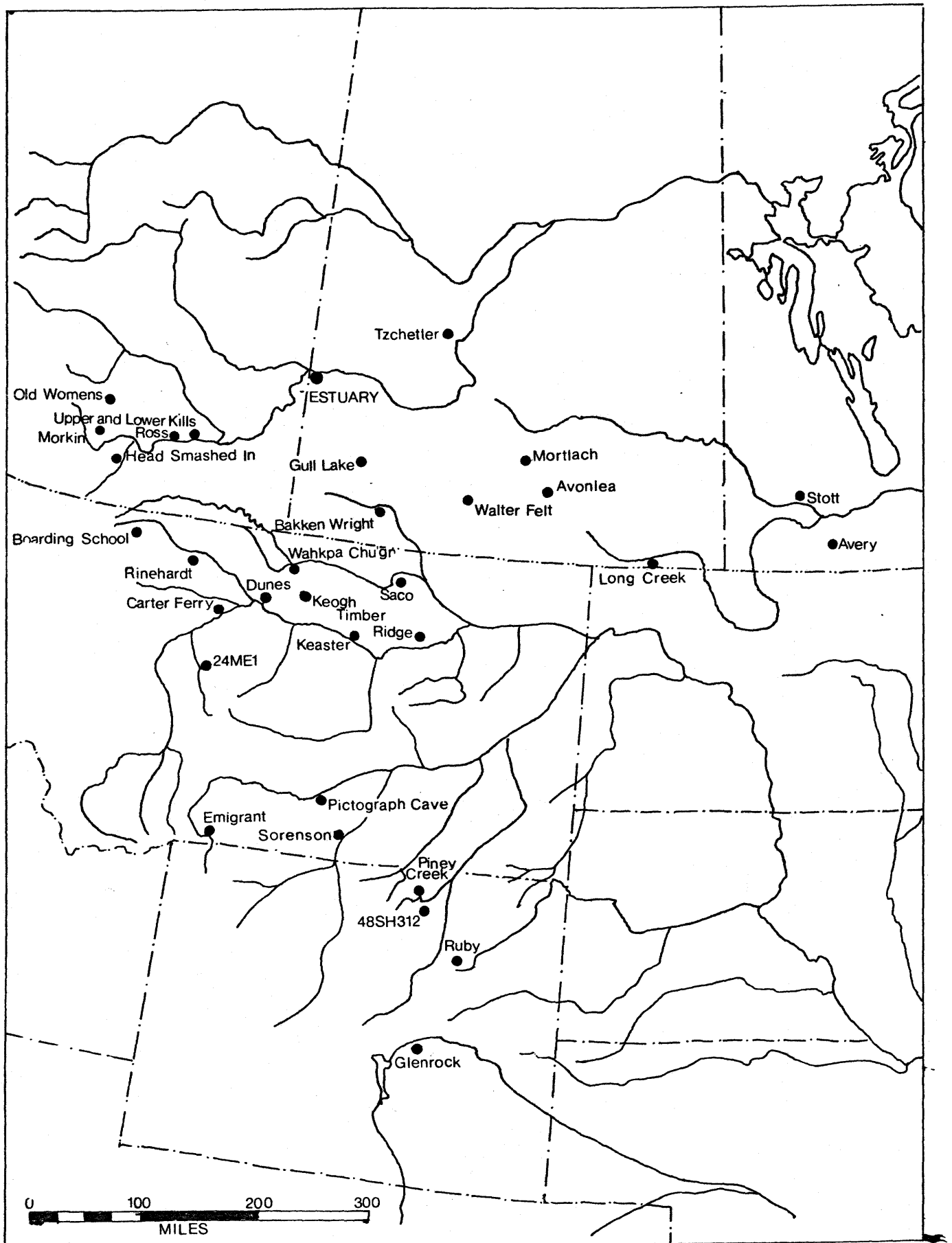


FIGURE 8

LOCATION OF SELECTED SITES ON NORTHWESTERN PLAINS

A.D. 660  $\pm$  60 (S254). Layer 24 is the only one with both Avonlea and Prairie Side-notched points and Layer 24d is dated at A.D. 730  $\pm$  80 (S149). Layers 24 to 15 are predominantly Prairie Side-notched and succeeding levels are Plains Side-notched.

Besides projectile points, other lithic tools include endscrapers, sidescrapers, regular formed knives, unformed bifaces, drills, teshoas, perforator/gravers, hammerstones, pecked stone balls, pecked cobbles and bell shaped pestles. The preferred artifact materials among the Avonlea components are petrified wood, chert, chalcedony, (half Knife River flint), quartzite and small amounts of other materials. The Prairie Side-notched tools are predominantly petrified wood, Knife River flint, chalcedony, chert, quartzite, and other materials.

No serious attempt has been made to compare unifacial tools but any of the Estuary endscrapers fit into the continuum represented by Kehoe's typology (Plate 17) while Type II sidescrapers have no similarity to any of his specimens. Estuary Type V unifaces occur throughout the Gull Lake sequence and are described as teshoas, almost invariably made of quartzite. Bifaces compare more favourably with Estuary Types I, IV, V, VII and IX in his Avonlea occupation zone. The Estuary components lack most of the other lithic tools.

The earliest Gull Lake site pottery comes from Layer 24, right on the border of the two phases. Bone tools include virtually the same working edges as Estuary. Furthermore, similar size ranges and bone selection is represented in both sites. Kehoe states that the highest concentration of bone tools is in Layer 24, the closest approximation to Estuary Level II.

Finally, using the parameters of high counts of mandibles, hyoids



and podial elements; medium amounts of lower limb bones, cervical vertebrae, thoracic vertebrae and scapulas; and small numbers of upper limb bones, pelvises, skulls, lumbar vertebrae and sacrums, Layer 26 appears most similar to Estuary's Level II. It also seems that from Layers 31a to 26, relative proportions of various bones tend to get increasingly more similar to excavated bone counts at Estuary. Layer 24 lacks the mandible and podial elements but is otherwise nearly identical. Layer 16 again approaches the Estuary count but more recent layers become increasingly dissimilar.

The Bakken-Wright site, situated on a terrace of the Frenchman River, is a jump site strongly resembling its neighbour, the Gull Lake site. Excavations conducted in 1972 (Adams 1975) reveal at least eleven occupation levels. Poor association between the pits resulted in a typological grouping into eight components, the accuracy of which is subject to critical consideration. The lowest culture bearing component, called G, is hypothetically identified as pure Avonlea phase. The three superimposed components all have a mixture of Avonlea points of Kehoe's Timber Ridge variety and Prairie Side-notched. The above components are all pure Prairie Side-notched in composition. Unfortunately, there are no dates for this site but the whole spectrum of diagnosed levels fits within a typological period ranging between A.D. 500 and A.D. 1300.

The unifaces are again uncomparred but both endscrapers and sidescrapers are essentially similar to Gull Lake and Estuary. Estuary Type IV, VI, VII and IX bifaces are all found but are supplemented by a large number of notched bifaces. Ceramics first appear in Component D, the most recent of the transitional components. Other tools include large, unifacially retouched flakes, unifacial and bifacial choppers, pecked

cobbles and grinding stones. Bone tools are scarce, mostly due to the extremely poor preservation but the same general tool categories are represented as those found at Estuary.

The vast majority of the small, formed tools such as projectile points, endscrapers and formed bifaces are made from petrified wood, chalcedony (including Knife River flint), chert and jasper, while larger tools are nearly all derived from quartzite cobbles. There are only three obsidian specimens, all from Components C and D but one of these is an Avonlea point.

Finally, a number of refuse pits are recorded at Bakken-Wright. One excavated pit shows deliberate preparation and utilization of more than one time. Its contents are very similar to those found in the unprepared refuse pile at Estuary.

All other bison killing sites in Saskatchewan are, as yet, unreported in detail. Of the remaining sites, Stoney Beach, Lake midden, Big Beaver midden and Buffalo Gap midden are all very recent pound sites (Kehoe 1973:162-3). The Tschetter site near Saskatoon has Prairie Side-notched points and extends over a very large flat area. It is either a single component pound or a surround containing Prairie Side-notched projectile points and ceramics. It dates around A.D. 1200 (Linnaeae, personal communication). The Avonlea site, tested in 1956 by B. McCorquodale (Kehoe and McCorquodale 1961a, 1961b), only has the projectile points described to date. The Avonlea type site has a radiocarbon date of A.D.  $450 \pm 100$  (S45). The Walter Felt site is a multicomponent pound, excavated in 1962 and 1964 by Kehoe. Though unpublished, various articles (Kehoe 1973:164, Ranere 1965:1) suggest that it has several Besant occupations, at least one characterized by Samantha projectile points

and dated at A.D.  $415 \pm 80$ . Two Prairie Side-notched components are dated at A.D.  $690 \pm 70$  and A.D.  $1250 \pm 80$ . Furthermore, one of the layers has positive indications of corral poles and supporting bone uprights.

The multiple component Long Creek site in southeastern Saskatchewan is an habitation site (Wettlaufer 1960). Level 2 at Long Creek has Avonlea projectile points, a Plains Side-notched point (probably intrusive), ceramics, awls, endscrapers, sidescrapers and a biface that resembles Estuary Type I. The primary bone remains are bison, few of which are complete. Other recovered faunal remains include deer (antler), frog (skeleton), rabbit (skull), pocket gopher (skull, scapula and humerus) and various shell remains.

A second multiple component habitation site is the East Pasture site, located near Swift Current (Millar et al:1972). There are several living floors in the site, of which at least one is represented by Prairie Side-notched projectile points, ceramics, small endscrapers and an Estuary Type VI knife. The hearths are all flat, surface burns.

The work in the Plains regions of southern Alberta is more oriented towards surveys and earlier sites. However, there are a few relevant excavated sites, most of which are bison kills, and only one of which is fully published.

The Old Woman's Buffalo Jump is located in a coulee in southwestern Alberta (Forbis 1962:57-123). It is a multiple component site that was excavated in two parts. Forbis divides his stratigraphy into an Upper Member and a Lower Member with the dividing line as a proposed division between Late and Late Middle Prehistoric periods. Layer 13, just above the division, is dated at A.D.  $860 \pm 80$  (S-87) and A.D.  $940 \pm 80$  (S-89).

Layer 17 is represented by Besant points and a radiocarbon date of A.D.  $310 \pm 60$  (S-90). Forbis' own interpretations (1962:83) put Layers 9 to 14 within the temporal range of comparison with the Estuary material. These levels contain a biface very similar to Estuary Type VI, several endscrapers, bifacially and unifacially retouched flakes, four grooved choppers, unifacial and bifacial choppers and pecked cobbles. There is no pottery or bone tools.

There is a large collection of projectile points from these layers, almost all of which are Prairie Side-notched and fall into Forbis' Nanton, Lewis, Irvine and High River varieties. There is little mention of the lithic materials but it appears that the usual plains materials are used with an increasing dominance of black chert or basalt in the lower layers of the Upper Member.

Head-Smashed-In Buffalo Jump, located on a cliff near Fort Macleod, is a multicomponent site that contains at least four major phases including Mummy Cave (Bitterroot), Pelican Lake, Avonlea and Old Woman's. Though partially excavated by several archaeologists, the only existing manuscript is by Reeves (1974). The Avonlea phase is represented by a 1.7 m thick layer of bone beds with initial dates of A.D.  $25 \pm 80$  (GX-1253), A.D.  $110 \pm 90$  (RL-330), A.D.  $305 \pm 130$  (GX-1252) and a rejected date. The terminal dates are A.D.  $910 \pm 140$  (GSC-983), A.D.  $950 \pm 110$  (RC-256) and a rejected date. The initial Old Woman's phase date is A.D.  $760 \pm 90$  (RL-257) which aligns better with the rejected Avonlea date of A.D.  $620 \pm 85$  (GX-1251) than with the accepted dates. Reeves (1974:16) mentions that some "Plains Side-notched" projectile points did occur in later Avonlea components. However, standard typology suggests that he means Prairie Side-notched.

The Avonlea phase also includes large numbers of small, asymmetrical bifaces, scrapers, retouched flakes of cryptocrystalline lithics, cobble and flake choppers, anvils and hammers. The first *pièce esquillée*s appear in later Avonlea components and lithics are dominated by cherts from Montana and the Canadian Rockies. The Old Woman's phase continues with similar lithics but bifaces become less formal through time while the lithic materials are less structured.

The Ross site, on the floodplain of the lower Oldman River, has three separate habitation layers (Forbis 1957). All three levels of the occupation site are Old Woman's phase though the lowest has a single Avonlea point. They contain Prairie and Plains Side-notched points, ceramics, pointed bifaces, awls, chisels, large bifaces, endscrapers, sidescrapers, graters, spokeshaves, choppers, pounders and spall scrapers. Of these, there are artifacts similar to Estuary Type VII bifaces and many of the Estuary unifaces. There are also four hearths at the site, two flat and two basin shaped as well as post moulds in Layer I.

The Upper and Lower Kills are both situated very close to the Ross site but while the Lower Kill also has Prairie Side-notched points, the Upper Kill has a mixture with Avonlea (Forbis 1957:Plate 1:26-33). The Lower Kill is interpreted as a probable pound while the Upper Kill is an ambush site, used when the animals are drinking. Besides the projectile points, neither site has ceramics and both have limited lithic tools similar to the Ross site. The Upper Kill has two knives, two biface fragments, a scraper plane, 13 unifacially retouched flakes with 167 points and point fragments. The Lower Kill is represented by a unifacial flake and two choppers along with 12 points. Bone tools are found at all three sites and are characteristic of the region.

The Morkin site (Byrne 1971, 1973) is a campsite-processing area, just east of the Porcupine Hills. It is broken into five levels, distinguished by Besant, Avonlea and Prairie Side-notched points. There is a questionable association of Besant and Side-notched points and a good association of Avonlea and Besant. While small, pointed bifaces and rectanguloid bifaces occur throughout the site, drills, ovate bifaces (Estuary Type I), lanceolate bifaces (Estuary Type VI) and large rectanguloid bifaces (Estuary Type VIII) all occur only with Avonlea points. Retouched flakes and most scraper forms are typical and persist throughout the site. Split pebble unifaces, graver/awls, microblade technique artifacts, cobble choppers and pebble choppers are all confined to the middle and upper levels. Ceramics occur only in Level 4 and above. Bone tools are similar to other Saskatchewan Basin sites and are concentrated in the middle and upper levels.

There are also a large number of hearths at the Morkin site that separate into two types. The most common form is a thin ash lens, resulting from an open, surface fire. These vary between 30 and 100 cm in diameter and are found throughout the site. The second hearth style is basin shaped, cobble lined, and less plentiful. There are also two pits located at the site. The first is a refuse pit, similar to that of Bakken-Wright, filled with shattered bison bone, fire broken rock and charcoal (Byrne 1975:670, Fig. 6). The second is much larger, measuring 350 cm from north to south. It contains a prepared floor of water worn cobbles and bison bones, particularly skulls, and dates from the Level 3 Old Woman's phase (W. Byrne, pers. comm.). It apparently is the remains of a pit that was utilized over a period of time, deserted and allowed to partially fill; then re-excavated at a later date to

a shallower depth (Byrne 1973:Fig. 7).

There is a long series of available dates for the Morkin site. The Level 5 Besant date is A.D.  $610 \pm 130$  (GX-2296). The mixed Besant and Avonlea Level 4 dates are A.D.  $760 \pm 130$  (GX-2294) and A.D.  $745 \pm 90$  (GX-2057). Level 3, which contains Prairie Side-notched and questionable Avonlea, has the dates A.D.  $1280 \pm 95$  (GX-1191), A.D.  $1250 \pm 90$  (GX-2060) and A.D.  $1155 \pm 85$  (GX-2056). The Level 2 Side-notched date is A.D.  $1700 \pm 95$  (GX-2055) and the Level I date is A.D.  $1845 \pm 90$  (GX-2054).

Finally, Quigg (1975:55-58) describes a three level habitation and processing site called Manyfingers from the Belly River. The lowest level of the second terrace is represented by Avonlea projectile points, endscrapers, sidescrapers, numerous choppers, perforators and early variant Saskatchewan Basin complex ceramics. Quigg notes that a few pieces of tourmaline chert come from the Purcell Mountains in British Columbia and some obsidian is derived from Yellowstone National Park in Wyoming. A series of two dates register at A.D.  $850 \pm 85$  (S-865) and A.D.  $875 \pm 90$  (S-866) while a date from a first terrace Avonlea kill component is A.D.  $570 \pm 70$  (S-722).

The two upper levels contain Old Woman's phase material but are poorly defined. However, they do contain ceramics.

Of the four excavated bison kill sites in Manitoba, only two fit into the given time range. The unreported Brockington site, excavated by Leigh Syms, is a pound site with a multicomponent kill and camp (Kehoe 1973:166). Kehoe also compares it to Layer 15 of Gull Lake, a transitional period between Prairie and Plains Side-notched. Syms, in a conference talk, has mentioned that it has postholes, some with

vertical bones in them.

A more recent Manitoba site, the Stendall site on Pipestone Creek (Rushowick 1975:3-30) is dated at A.D. 1100  $\pm$  75. It has a large collection of projectile points, essentially Prairie Side-notched in appearance. The bifaces include irregular, triangular and ovoid outlines. There are also endscrapers, sidescrapers, retouched flakes, perforators, hammerstones, ceramics and bone tools. Unfortunately complete descriptions and photographs are lacking, making comparisons difficult. There are also 21 features of vertical bones. Though most occur individually, eight are associated with post moulds. Most of the recovered bone is bison which leads Rushowick to speculate that the site is a pound. However, a large variety of other species are also represented in the faunal remains.

The only reported Manitoba site with Avonlea points is the Avery site. Excavations have been conducted at various times since 1944 (Joyes 1970:209-222) but extreme mixing of the levels has consistently foiled analysis. However, Joyes interprets the Avonlea phase to include points, lanceolate (Estuary Type VI) bifaces, crescent shaped bifaces and rectangular (Estuary Type VII) bifaces.

The Avery site, along with Stott Mound (MacNeish 1954, 1958) and the United Church site (MacNeish and Capes 1958) are all early southwestern Manitoba sites that demonstrate the Manitoba phase, a north-eastern plains alternate to the Old Woman's phase. They are associated with side-notched projectile points, Blackduck pottery, lamellar and plano-convex end scrapers, various bifaces, burial mounds, bone tools similar to western varieties and a broad subsistence base. The earliest date on Blackduck ware is A.D. 798  $\pm$  120 at the Scott site in Minnesota



(Joyes 1970:217) but the Manitoba sites all date to a somewhat later period.

Montana was apparently the centre of bison killing enterprises as far back as the Early Middle Prehistoric Period. Kehoe discovered 50 bison kill sites in the Blackfoot Reservation alone (Kehoe 1967:10) and the Milk River Archaeological Society recorded a hundred more along the north half of the state (Kehoe 1973:166, Davis 1966).

One of the earliest excavated sites in Montana is the Boarding School Bison Drive (Kehoe 1967). It is located near the headwaters of a major branch of the Marias River in northwestern Montana. The site is described as a pound by Kehoe and is dated at A.D. 1590  $\pm$  50 (M-1066). Though late for consideration as a directly comparable site, it seems worthy of mention. The projectile points are essentially Plains Side-notched but 15% (32) are Prairie Side-notched. The scrapers are comparable to Estuary as are some of the bifaces. The single specimen of knife Type I may be a very large, late variant of Estuary Type VI biface. There are also specimens that strongly resemble Estuary Types VII and IX. Kehoe also describes cobble choppers, a few pieces of ground stone and a large percentage of modified flakes in the flake sample. A large portion of these flakes are of obsidian as are a number of the artifacts. The 133 bone tools are essentially the same as those recovered from Estuary and Gull Lake. Finally, features include corral remains, a charred bone layer, an ash pit, a circular rock feature, a hearth and two instances of vertical long bones that have been alternatively interpreted as an anvil or corral post wedges.

The Wahkpa Chu'gn site is a multicomponent jump site, located on the Milk River in northern Montana (Davis and Stallcop 1966). Like the

Bakken-Wright site, the testing methodology means that phase alignments between excavation units can be questioned. However, the authors interpret Level II, Area A as A.D.  $600 \pm 75$ , Level I, Area A as A.D.  $800 \pm 200$  (1175  $\pm$  200 B.P. obsidian hydration date) and Level I, Area B as A.D.  $350 \pm 75$ . All other levels are more recent than desired for comparison.

All three dated horizons are interpreted as bone middens that result from drive sites. The artifacts from these three levels are primarily projectile points. The Area B material is diagnosed as Besant, the Level II, Area A as Avonlea, and Level I as Prairie Side-notched.

The more recent levels contain a larger inventory of tool types including long, lanceolate bifaces (Estuary Type VI), various scrapers, bone awls, bone pendants and beads, pipestem fragments and larger tools. Hearths are common in some areas and are generally flat and rock ringed. Finally, an unidentified lower level in Area A has three post moulds, two of which have skulls and long bones rammed into them. The authors do not believe that this feature is part of a pound as context and location are not appropriate. Instead, they suggest that it may have been part of a habitation but its use as a ceremonial structure is also possible.

Further investigations at the site were conducted by Brumley (1971: 11-39) in 1970. His researches at Area A provided two dates. The Side-notched layer date was A.D.  $550 \pm 80$  (GaK-2503) and the earliest, undefined component was 50 B.C.  $\pm 70$  (GaK-2502). He also expanded the knowledge on the structure in the lowest level. He found that the post pits each contained two posts, forming a large arc. He discovered that it was rebuilt or repaired several times. Brumley's definition of levels varied from the preceding excavations. He listed nine levels which

contained Avonlea, Prairie Side-notched and Plains Side-notched projectile points with the possibility of a Besant component below.

The Kobold site, excavated by Frison (1970b:1-35) is a multiple component kill on Rosebud Creek in southern Montana. Of the four horizons, Levels III and IV can be typologically used for comparison. Level III is represented by larger, corner-notched points, reminiscent of the Samantha variant of the Besant point. It also has asymmetrical ovate bifaces, a couple of scrapers and modified flakes. Level IV has 220 projectile points, all late Plains Side-notched, large lanceolate bifaces (similar to the Boarding School Type I), retouched flakes, endscrapers, a hammerstone, steatite pipes and ceramics.

There are also a large number of drive sites that have been either poorly reported, or have cultural deposits that are considerably distant from the comparative parameters. The Keaster site (Davis and Stallcop 1965) is a pound with four occupation levels. The lower horizons are Pelican Lake or Besant while the uppermost is late in the Prairie Side-notched complex. The Carter Ferry Buffalo Kill is a pound site located on the top of a bluff overlooking the Missouri River (Shumate 1967:1-10). It is represented by the Pelican Lake phase. The Keogh Buffalo Jump (Conner 1962b:8-11) is located at the base of the Beartooth Mountains and is probably Plains Side-notched. The Madison Bison Jump (Malouf 1962:12-16) is located on the Madison River, south of Logan. Its affiliation is unknown. The Emigrant Drives consist of two sites on the upper Yellowstone River (Arthur 1962:16-27). The larger site is a jump of Plains Side-notched association. The smaller, 24PA309, is a pound site, essentially Besant, with evidence of post moulds. Another Plains Side-notched jump, reported by Hoffman (1962:196-201) as 24ME1, is

located on the Smith River drainage in central Montana.

In a search for Avonlea phase sites, Davis (1966) lists eight more sites. The Timber Ridge site, the type site for Kehoe's variety of the same name, is a single component pound site, located between the Bearpaw and Little Rocky Mountain ranges. There is at least one posthole, complete with rotted wood and bone tamped around it. The bone midden is 45 m in diameter. As well as points, there are a number of reported knives and scrapers. Some of the knives have one straight edge, a diagnostic Avonlea trait, and one is notched. Two obsidian points are dated at A.D.  $770 \pm 120$  and A.D.  $120 \pm 130$ . A collagen date is A.D.  $970 \pm 110$  (GX-1195).

The Three Buttes site is a multicomponent jump with lanes, near the Milk River. It contains Avonlea and Prairie Side-notched points as well as Estuary Type VI bifaces of unknown provenience. The Crawford site is a pound just off the Teton River, west of Choteau. The bone bed is 50 feet in diameter and shows evidence of general burning on the down-slope side. It contains Avonlea and Prairie Side-notched points in association with "Timber Ridge site" knives, two Besant points and sandstone milling slabs. Two obsidian dates on Avonlea points both registered at A.D.  $250 \pm 300$ . The Big Badger site is an Avonlea jump southeast of Browning. The Saco site is a jump near the town of the same name. It appears to be a multicomponent site with an Avonlea level containing Estuary Type VI bifaces. The Rhinehart site on the Marias River is the last of the kill sites mentioned.

Two habitation sites are also reported by Davis. The Dunes site, on a bench of the Missouri River, has several levels including a sparsely represented Avonlea. Site 24BL402, on a floodplain of a Missouri River

tributary, is a surface site that includes Avonlea and side-notched projectile points with ceramics.

Another six sites, all located on the Milk River in central Montana, have been briefly described by Hoy (1973:1-34). The Salisbury Bison Kill was located on a coulee, back from the river. It was a jump site with two bone levels, 25 m below the cliff edge. Though the provenience of the recovered artifacts was indeterminate, the range of projectile points exactly matched those of the Estuary site, including all the same styles. The Saco site, an impoundment previously mentioned by Davis (1966) had four occupation levels just off the Milk River. One of these levels had been burned. The projectile points ranged between Avonlea and Prairie Side-notched types. There was also a knife that resembled Estuary biface Type II. The Sleeping Buffalo Bison Kill was a single component drive site with cairn drive chutes. It had Avonlea and Prairie Side-notched projectile points, a graver, large cobble tools and several pieces of freshwater clam. The Milk River Kill #4 was located a few miles downstream from the Sleeping Buffalo site. It was a multi-component site which included Prairie Side-notched projectile points. Site 24PH602 was a three layer impounding site near Malta. The majority of projectile points appeared to be late Plains Side-notched. The Ten Twenty site was extremely complex with a large artifact assemblage from ten acres of a single component kill. It appeared to be composed primarily of Plains Side-notched projectile points, with a few Prairie Side-notched projectile points.

Bison drives in Wyoming are almost all excavated through a program established by G. Frison. However, he has not yet reported on any that fit into the required time spectrum, though he has found sites that

extend over a long time period. Sites 24PR5 and 48SH311 are both Early Middle period kills that date at  $2500 \pm 125$  B.C. and  $650 \pm 200$  B.C. respectively (Frison 1967b). Site 48SH312 is a third site in the same region, on the Powder River, with a geological date of 3500-400 B.P.

The Ruby site (Frison 1971:77-91) is a fourth kill, this time a pound, on the Powder River. It is dated at A.D.  $280 \pm 135$  (GX-1157) and is the closest comparable site from Wyoming. At Ruby, there are a large number of postholes, some of which show evidence of being tightened with bison mandibles, ribs and humeri. Other postholes, in the centre of the pound, are interpreted as impaling sticks. Finally, there are indications of a structure 6.1 m east of the pound. It is interpreted to be 11.8 m long and 4.6 m wide with the sides taking on an archlike form. Frison suggests that it is a ceremonial structure.

The projectile points appear to range in shape between Pelican Lake and a variant of Besant. Other tools are infrequent but include bifaces, endscrapers, milling stones converted to hammerstones, and a few bone tools. There is also extensive evidence of retouch flaking and other auxiliary activities which are indicated by surface type hearths. Finally, the butchering process seems to alter considerably from other accounts. At the Ruby site there are few broken long bones; jaws are removed intact; forelimb bones are the most commonly recovered; caudal vertebrae are absent; and pelvi, femurs, and tibiae are relatively common.

Two final excavations are both extremely recent. The Glenrock Buffalo Jump (Frison 1970a) on the North Platte River is a single component site, and has two dates of A.D.  $1740 \pm 100$  (M-2350) and A.D.  $1670 \pm 100$  (M-2349). The Piney Creek sites (Frison 1967a), north of

Buffalo, include a kill with the dates A.D. 1580  $\pm$  100 (M-1748) and A.D. 1610  $\pm$  100 (M-1747). The killing and butchering elements are very similar between these two sites, especially in reference to artifact retrieval, bone tools and butchering processes.

## CONCLUSIONS: THE ESTUARY SITE IN THE LATE PREHISTORIC PERIOD

### THE LATE PREHISTORIC PERIOD

On the Northwestern Plains, the Late Prehistoric period was initiated by the Avonlea phase. This phase was originally described by Kehoe and McCorquodale (1961a:137-139, 1961b:179-188) who coined the term "Avonlea point" for a small, thin side-notched projectile point found at the Avonlea site. The type site was a bison trap located in southern Saskatchewan that dated at A.D.  $450 \pm 100$  (S-45). At that time they also noted the frequency of Avonlea point occurrence with bison drives and the lack of brown chalcedony. They also mentioned "degenerate, thick-eared, Avonlea-like, short points" found at Gull Lake (1961b:186) and the absence of good ceramic contexts with the point.

Leslie Davis (1966:100-116) expanded the range of this point type by acknowledging Avonlea point occurrence in several Montana sites. He reaffirmed the general description and association with drive sites but extended the range of the point southwards into west-central Montana. He also suggested that one or two knife styles might have to be included in the complex.

In the same year, Kehoe (1966:827-841) further refined his ideas and incorporated his thoughts on the entire Late Prehistoric Side-notched tradition. He suggested three varieties of Avonlea points. The "Gull Lake" was the classic, type site variety which he dated at A.D.  $210 \pm 60$  (S-255) at the Gull Lake site. This date remains as one of the earliest for the Avonlea phase. The Carmichael Wide-eared variety was cruder with larger notches and wider ears. This had a late date of



A.D. 730  $\pm$  80 (S-149) at the Gull Lake site. The Timber Ridge Sharp-eared variety were described as a later form with poorer workmanship, rounded ears and larger dimensions than the Gull Lake variety. In an attempt to explain the emergence of this somewhat unusual point type, he suggested that Athapaskan invaders, familiar with communal hunting techniques and lacking ceramics, forced themselves into the Saskatchewan Basin, upsetting the indigenous Besant phase. The primary basis for this speculation was that his early Avonlea dates corresponded well with Hoijer's (1956) lexicostatistic date for the breakup of the Athapaskans.

Wilfred Husted (1969:92-94) discovered "Avonlea-like" points in Mangus III in the Bighorn Canyon. He traced the southward extension of these points to a terminal area around the Montana-Wyoming border. He then suggested that the Avonlea complex extended south from Canada and reached its maximum extent at about A.D. 650. From there, some traits were picked up by the Shoshoni who were in contact to about A.D. 900. From its southern limit the Avonlea complex then pushed east into South Dakota. He also rejected Kehoe's original hypothesis on the basis that the point did not continue below the Montana border, a necessity if it was an Athapaskan trait. Instead, he vaguely mentioned "Siouan peoples (early Mandan-Hidatsa?)".

Brian Reeves (1970b) attempted to synthesize the Avonlea data. He extended the borders from southwestern Manitoba (Avery site) across the Canadian plains and parklands to the foothills and south to the Big Horn Basin and the Montana-Wyoming-South Dakota intersection. He indicated that it was as early as A.D. 150-250 and was replaced by Besant at A.D. 700. As well as the known points, he extended the artifact assemblage to include asymmetric bifaces that tended to alter through time from

ovate to lanceolate in form, diamond-shaped bifaces, symmetric lanceolate bifaces, pointed unifacial flakes, and fabric-impressed, bossed or punctated vessels. He further indicated that jumps, pounds and traps were all used as bison kills and that bison were the primary food source. A possible burial pattern was represented by primary flexed or extended pit burials. He also speculated that the Avonlea point was the first used on the bow and arrow on the Northwestern Plains.

He tried comparing various attributes of the Avonlea phase to a number of surrounding phases and found little that was contemporary or earlier with similar attributes. He then compared Avonlea with the indigenous Pelican Lake phase of the "Tuxana tradition" and with the "Napikwan tradition". The latter was represented by the Besant phase, which he suggested was an intrusive element to the plains. Reeves' conclusion was that the Avonlea phase developed indigenously from Pelican Lake as a reaction to the introduction of the bow from the west. The Tuxana tradition was later to be supplanted by the Napikwan tradition (Table 5).

Most recently, Byrne (1973:454-462), in an analysis of Late Prehistoric ceramics, has added to the discussion. Like others before him he rejected Kehoe's original hypothesis. Instead, he utilized Reeves' original interpretation and suggested that the Avonlea complex gained use of pottery from the eastern boreal forest. However, he disagreed with Reeves' opinion of Avonlea-Besant interaction. He believes that the Besant phase lacked ceramics and that the Avonlea phase eventually predominated.

To date, the Avonlea phase is best described as an indigenous phase that developed from the Late Middle Prehistoric Pelican Lake phase and reacted to the introduction of the bow and arrow from the west and pottery from the east. It seemed to develop in the Saskatchewan Basin

between A.D. 150 and A.D. 250, then spread westward to the foothills and south to the Montana-Wyoming border. It had an economy based primarily on bison hunting and made extensive use of trapping mechanisms. There also appears to have been a selection for specific, diagnostic lithic materials, projectile point and biface styles and ceramics. There is, however, some argument as to its succession and to its relationship with the Besant phase.

It has long been accepted that the next identifiable complex revolved around major changes in the small side-notched projectile point styles. The earliest assessments of these (Mulloy 1958, MacNeish 1958, Wettlaufer 1955, 1960) were little more than descriptive but Forbis (1960) launched into an extensive typological-seriational discussion on the extensive sample of points recovered from the Old Woman's Buffalo Jump. He defined seven varieties and ordered them chronologically.

Kehoe (1966:827-841) expanded and categorized the small points. He grouped 17 varieties into three types: Avonlea, Prairie Side-notched and Plains Side-notched which he felt to be significantly differentiated in form and time to be representative of separate complexes. The Avonlea complex has been discussed. The Prairie Side-notched points were described as crude, irregular, small, side-notched points that ranged from A.D. 700 to A.D. 1600. The Plains Side-notched were slightly larger with finer detail, greater symmetry and better flaking. He suggested that they appeared around A.D. 1300-1500 and continued on to contact times. He further suggested that the Prairie Side-notched point evolved from the Late Middle Prehistoric Besant phase while the later type was derived from expansion of the Mississippi villages.

Surprisingly, very little has been done to extend knowledge of the

tool assemblages and cultural patterning of these groups. Apparently, most regional researchers are not overly concerned with cultural dynamics of recent prehistory but prefer to rely on ethnographic analogy.

However, Reeves (1970b:205-217) agreed with Kehoe's origin postulation by suggesting that the Napikwan tradition gradually dominated over the Avonlea and by A.D. 750 had evolved into the early Prairie Side-notched varieties which he termed the Old Woman's phase.

Byrne (1973:454-470) countered this argument with two sources of evidence. In a study of Late Prehistoric ceramics, he found pottery remains in Old Woman's phase sites and Avonlea phase sites (contrary to Kehoe) but not in Besant (contrary to Reeves). Furthermore, the ceramic data represented in the two phases followed a single tradition which he termed "Saskatchewan Basin". He also conducted a coefficient of divergence and population divergence tests on the metrics of projectile points found at the Morkin site. This site had all three phases represented and consistently displayed a higher degree of correlation between the Old Woman's and Avonlea than between Besant and Old Woman's. From these studies, he concluded that Besant and Avonlea either converged to produce a new phase or else the Avonlea phase supplanted the Besant.

The Estuary Bison Pound appears to present information that would help clarify this situation. The data from Level II has been demonstrated to include definitive traits of the Avonlea phase. The Type III projectile points were both metrically and non-metrically describable as Avonlea. There were also examples of lanceolate bifaces and other forms of asymmetric bifaces, ceramics, a bison oriented economy, a preference for local cherts, petrified wood and brown chalcedony and a lack of obsidian. However, it also contained recognizable Old Woman's phase

projectile points, hearth styles and butchering practices. Furthermore, the date was A.D.  $770 \pm 165$ , a perfect date for emergent Old Woman's phase features (Reeves 1969:35, 1970:18). Level I retains the essential character of Level II, including many of the artifact forms, lithic industry, hearth style and butchering practices. However, it does lack the key Avonlea projectile points and is represented by two dates: A.D.  $740 \pm 80$  and A.D.  $890 \pm 70$  (mean A.D.  $815 \pm 75$ ). The mean separation between the two components is 145 years.

The recovery from these two occupations strongly suggests that the Avonlea phase extended beyond original speculations, an indication supported by Avonlea phase dates of A.D.  $745 \pm 90$  and A.D.  $760 \pm 130$  at the Morkin site and A.D.  $1095 \pm 90$  at the Upper Kill site, both in Alberta (W. J. Byrne, pers. comm.). It further indicates that Avonlea either outlasted or assimilated the Besant phase and that the Tuxana tradition was responsible for the development and proliferation of the Old Woman's phase.

#### THE ESTUARY SITE

From the above discussions and comparisons, three levels of conclusion can be determined. First, the two components at Estuary are similar in character and functions but are separated by typology and time. Second, if there is some form of distinguishing character between the Avonlea phase and the Old Woman's phase, as is generally described, then this site sits right on the border between the two. Third, this border phase should have some diagnostic attributes that can be tested if it is indeed unique.

To summarize and consolidate, while Level I at the Estuary site can be assigned to the Old Woman's phase, Level II has characteristics

of both that and the Avonlea phase. It is characterized by the occurrence of projectile point forms common to both phases; small, formed bifaces that grade between ovate and lanceolate but are always asymmetrical, often with one side nearly straight; a reliance on more or less local lithic material; a bison based subsistence pattern; ceramics; extensive use of bison pounds and jumps; bone tools; flat and basin shaped hearths; possible ceremonial structures; and utilization of a more or less standard Plains Indian tool kit including scrapers, pièce esquillées, hammerstones, cobble choppers, grooved mauls, milling or grinding stones, large scrapers (teshoas), drills, awls, perforators, concave scrapers (spokeshaves), bone awls, needles, knapping and butchering tools and various decorative artifacts. It occurred somewhere around the latter half of the A.D. 700's but may have extended up to A.D. 1100. Like the earlier originating Avonlea, it may have begun in the Saskatchewan Basin and diffused from there. This subphase, called the Leader subphase (Willey and Phillips 1958:24), is represented by Level II of the Estuary site (A.D.  $770 \pm 160$ ), Layer 24 of the Gull Lake site (A.D.  $730 \pm 0$ ), Components C, D and E of the Bakken-Wright site, Level 4 at the Morkin site (A.D.  $760 \pm 130$ ), and the Sleeping Buffalo Bison Kill. It may also be represented in the Three Buttes site, the Crawford site, 24BLH02, the Salisbury Bison Kill and the Saco site.

The Leader subphase has its roots and its succession in the phases that bracket it. However, the extent of influences and introduction of new elements is, as yet, only partially determinable. This can be demonstrated in a brief discussion of its diagnostic attributes.

The most obvious attribute is the dual occurrence of two different projectile points that have been used to define separate phases. Despite

the statements by Kehoe and Reeves that the Old Woman's phase developed out of Besant through the Samantha subphase, the mixing of Avonlea and Prairie Side-notched in one component in several sites, plus statistical analysis on Estuary and Morkin site points, strongly suggests Avonlea - Prairie Side-notched affinities. Furthermore, the distinctive biface styles, originally attributed to the Avonlea phase by Reeves (1970:177), have been found consistently in Leader subphase components. These same bifaces persist into the Old Woman's phase but tend to become larger in size. The remaining lithic tools are virtually undiagnostic except in a presence - absence state which is difficult to validate in a site specific analysis.

The lithic industry itself has proven to be quite distinctive. The emphasis in most sites appears to be on cryptocrystalline quartzes of local origin, especially petrified wood, chalcedony and chert. Towards the west, sites have increasingly larger samples of basalts and argillite from the mountains and to the east there are significant percentages of brown chalcedony. However, there is virtually no use of obsidian, even in Montana sites, even though it is highly utilized in some later sites. These lithics are augmented by extensive use of local cobble quartzites for larger tools in the till areas. Comparatively speaking, this lithic representation is much closer to pure Avonlea sites than to many pure Besant sites which can be almost entirely made up of brown chalcedony (Gruhn 1971:142, Reeves 1970b:94-5). The lithic inventory does not change significantly in early Old Woman's phase sites.

The ceramics present a different distribution pattern which has become a theoretical contention in the literature. Kehoe and Kehoe (1968:31) suggest that ceramics do not occur with "classic" Avonlea points but are

found with Besant (Kehoe 1964). Reeves (1970b) gives ceramic descriptions for both phases but Byrne (1973) discredits the Besant ceramics and gives a strong argument for ceramics in association with Avonlea, at least in the Saskatchewan Basin. Without additional information, these arguments can lead to any conclusion desired, including the one that there are no ceramics with any phase before Old Woman's.

However, this situation can be altered if the evidence is approached differently. A list of ceramic bearing components taken from the above comparisons, which include all three phases, are alike in one feature: they do not predate A.D. 700. There are numerous examples of ceramics associated with Avonlea but they always postdate A.D. 700 or else they are in dual association with Prairie Side-notched points. If, by the term "classic", Kehoe means Avonlea sites that do not include either of these attributes, he appears to be right. This still leaves a considerable number of ceramic associated Avonlea components. The Besant evidence of ceramics is scarcer but Besant phase sites of so recent an age are also fewer. To date, earlier Besant sites with ceramics all have very poor associations. Incredible as it may seem, this makes Byrne's basic contention correct and still does not refute Reeves' contention. Conversely, future work may prove that all three viewpoints are incomplete. Instead, it appears that any cultural assemblage that existed in the Saskatchewan Basin at A.D. 700 stood a reasonable chance of adding ceramics to their tool inventory. From this date, the later the site, the greater this chance becomes (Table 5).

The bison based economy and reliance on bison killing sites has a long tradition in the Northwestern Plains. Prepared pounds date at least as far back as the Pelican Lake phase of the Late Middle Prehistoric



at the Keaster and the Carter Ferry sites and more generalized sites occur throughout the prehistoric sequence. Kehoe and Kehoe (1968:28-30) suggest that the Avonlea phase was an intrusive element that brought the ritualized communal hunt in from the north. Kehoe (1973:199) apparently still supports that basic hypothesis. However, overwhelming evidence of pounds in Pelican Lake and Besant phases give little credence to this contention. The Ruby site is a Besant site with the earliest structural evidence of a possible ceremonial structure. In fact, bison pounds at Muhlbach, Ruby, Walter Felt and Richards, all with post moulds, middens and butchering areas appear to reach an efficiency level that was not surpassed in later centuries.

Together, these facts lead to a speculation on Late Prehistoric development that would explain the existence of the Leader subphase. If, as Reeves suggests, the Tuxana and Napikwan traditions existed simultaneously in the Northwestern Plains, then interaction was inevitable. It appears that the Avonlea phase first utilized the bow and arrow technology while the Besant phase may have introduced new efficiency in communal bison hunting patterns. By A.D. 700 the Besant phase had adopted the arrow and influenced projectile point styles. At about the same time, there was an infusion of ceramic technology that probably progressed from east to west. With the changes introduced by new point styles and the introduction of ceramics, the Napikwan tradition continued on into the Old Woman's phase while the Tuxana tradition was either assimilated or died out. The Leader subphase represents the key pivotal point that occurred between A.D. 700 and A.D. 1100.

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TABLE IA PROJECTILE POINT METRICS: LEVEL I

Prairie Side-Notched Projectile Points (Type I)

LEVEL I POINTS	Overall Length	Shoulder to base	Maximum width	Maximum width from base	Width of base	Maximum thickness	Maximum thickness from base	Notch depth - L	Notch depth - R	Notch width - L	Notch width - R
74E4	19.7	6.35	13.15	7.2	11.25	3.4	11.25	4.0	2.0	2.95	1.85
70E26	19.5	7.65	12.4	8.05	11.9	4.15	8.2	2.95	2.95	4.0	3.6
69E179	22.55	5.5	14.3	3.3	14.3	4.3	7.55	1.5	1.5		5.0
69E178	20.35	7	14.15	3.7	14.15	4.3	4.9	1.95	1.25	2.6	4.45
67E1		5.45				3.95	7.8				
64E9		6.7				2.3	11.5		2		3.95
64E10		6	9.7	2.7	9.7	4.15	4.7	2.0	1.0	2.55	2.8
64E2		4.6	12.75	2.25	12.75	3.65	6.3	1.7	2.5	1.35	3.75
64E11		7.25	13.2	.75	13.2	3.65	5.45	1.6		3.65	
57E33		5.4				3.75	8.9	1.65		3.85	
57E41		5.65	12.7	7.4	11	2.3	3.5	2.65		3.4	
57E32	21.35	5.95	12.45	5.3	12.2	3.05	8	2.45	1.55	2.85	3.55
55E9	15.2	6.7				2.95	7.95		2.15		2.4
47G66	16.9	7.55	12.6	3.65	12.6	3.75	7.8	2.25	2.25	3.8	3.9
46G115		7.1			4.8				2.25		2.85
44E1		5.5	14.5	5.7	13.6	2.6	7.1	2.0	2.6	3.0	2.95
41E38		5.35			8.5	1.5	5.75	1.95		3.5	
25E2		5.9	13.25	7.3	12.45	3.25	3.5	2.4	3.5	2.5	3.4
23E2		7.45	16.55	7.45	16.55	3.45	9.75	2.0	2.5	2.65	3.65
22E6	19.5	6.35	12.95	6.5	12.55	3.35	8	2.9	2.8	2.8	2.85
21E10	13.0	5.8	13.75	3.0	13.75	3.0	7.6	1.05	1.35	2.55	3.2
20E6	21.85	6.75	18.95	1.8	18.95	3.75	8.8	1.0	1.1	3.5	4.0
19E7		8	14.95	7.1	14.95	4.8	11.95	2.9	3.7	4.2	3.5
18E1		6.7	9.55	8.1	9.5	4.3	7.4	2.9	2.15	3.95	3.65
HE7		5.65	14.7	3.4	14.7	3.0	9.7	1.25	1.55	2.85	4.0
TE11		4.2	11.4	2.2	11.4	3.1	7.9	1.1	1.25	2.4	1.8

TABLE IB PROJECTILE POINT METRICS: LEVEL II  
Avonlea Projectile Points (Type III)

LEVEL E <sub>1</sub> POINTS	Overall Length	Shoulder to base	Maximum width	Maximum width from base	Width of base	Maximum thickness	Maximum thickness from base	Notch depth - L	Notch depth - R	Notch width - L	Notch width - R
75E <sub>1</sub> 5		6	14.45	3.65	14.45	3.35	8.7	2.0	1.35	2.2	2.2
75E <sub>1</sub> 4	21.65	5.5	13.5	3.2	13.5	2.6	7.25	1.8	2.4	2.7	2.5
72E <sub>1</sub> 1		6.7	14.4	3.4	14.4	3.4	10	1.8	1.15	3.45	3.35
72E <sub>1</sub> 26	21.0	5.8	12.8	3.4	12.8	3.3	14.1	2.3	1.9	2.5	2.9
71E <sub>1</sub> 9		6.0				3.1	8.35		1.85		3.0
70E <sub>1</sub> 19	25.95	5.9	15.95	3.1	15.95	3	6.9	2.15	1.95	2.4	2.6
70E <sub>1</sub> 21		9.55	14	6.3		3	7.1	1.6		3.0	
70E <sub>1</sub> 14		5.95	12.2	2.35	12.2	2.6	4.6	1.4	1.35	4.25	2.6
70E <sub>1</sub> 16		6.9	13.4	3.35	13.4	3.0	10.45	1.55		3.6	
69E <sub>1</sub> 10	24.5	9.35				3.75	8.25	1.4		5.25	
69E <sub>1</sub> 155	20.95	5.95				3.4	4.45		2.5		2.35
69E <sub>1</sub> 158	21.0	5.65	12.45	3.6	12.45	3.1	9.3	1.95	1.45	3.0	2.15
68E <sub>1</sub> 149	23.1	6.2	15	2.55	15	3.4	10.1	1.25	1.2	3.7	2.2
67E <sub>1</sub> 77	23.1	6.9	13.65	2.2	13.65	2.95	6.85	1.15	2.25	4.3	4.5
67E <sub>1</sub> 68		5.75	13.45	2	13.45	3	8.2	1.45	1.3	3.4	3.15
67E <sub>1</sub> 75	24.3	7	13.25	3.6	13.25	3.7	11.0	2.95	2.9	3.0	3.15
65E <sub>1</sub> 20		5.6				3.6	9				
65E <sub>1</sub> 18		7.45			11			2.0	1.6	2.35	2.45
64E <sub>1</sub> 12		5.15	15	3.15	15	3.2	7.4	2.0	1.75	2.8	2.35
64E <sub>1</sub> 26	20	7.15	14.65	4	14.65	3.3	8.2	1.6	1.95	3.65	3.15
64E <sub>1</sub> 11	25	6.9	15.0	3.25	15	3.95	9.5	1.25	1.45	3.15	3.15
64E <sub>1</sub> 25		4.5	13.35	2.9	13.35			1.2	1.2	1.9	1.85
55E <sub>1</sub> 24	23.45	6.95	14.6	2.2	14.6	3.7	8.8	1.95	2.0	3.5	3.35
55E <sub>1</sub> 25	23	5.5				3.0	10.75	2.15		2.25	
51E <sub>1</sub> 79	17.7	6	12.95	2.5	12.95	3.25	7.25	1.2	1.95	3.85	3.0
43E <sub>1</sub> 22		6.65	13.8	3	13.8	3.2	7.8	1.6	1.55	2.9	3.15

TABLE IB  
Continued

PROJECTILE POINT METRICS: LEVEL II

Avonlea Projectile Points (Type III)

LEVEL E <sub>1</sub> POINTS	Overall Length	Shoulder to base	Maximum width	Maximum width from base	Width of base	Maximum thickness	Maximum thickness from base	Notch depth - L	Notch depth - R	Notch width - L	Notch width - R
33E <sub>1</sub> 8	20.96	5.55	15.2	2.85	15.2	2.95	13.8	2.1	2.15	2.35	2.25
24E <sub>1</sub> 7		5.2	14	2.45	14	2.9	7.3	2.0	1.45	2.75	2.2
19E <sub>2</sub> 16	21.8	6.9				4.45	13.6	1.95		3.0	
3E <sub>1</sub> 55	17.7	6.25	12.85	6.6	12.6	2.7	7.8	1.3	1.9	3.0	2.6
3E <sub>1</sub> 57		5.8	14.15	7	13.65	2.75	9.45	2.9	2.15	2.95	2.45

TABLE IC PROJECTILE POINT METRICS: LEVEL II

Prairie Side-Notched Projectile Points (Type I)

LEVEL II POINTS	Overall Length	Shoulder to base	Maximum width	Maximum width from base	Width of base	Maximum thickness	Maximum thickness from base	Notch depth - L	Notch depth - R	Notch width - L	Notch width - R
76E <sub>1</sub> 9		5.95	13.6	2.25	13.6	3.1	6.7	2.0	7.0	3.0	
76E <sub>1</sub> 5	17.45	5.65	11.55	2.25	11.55	2.9	10.3	1.25	1.95	3.6	3.0
76E <sub>1</sub> 1	24.4	5.9	15.85	6	15.3	4.3	9.3	2.3	1.95	4.0	3.3
76E <sub>1</sub> 3	21.35	6.55	14.65	1.7	14.65	3.8	7.2	2.5	2.75	3.6	4.75
74E <sub>1</sub> 9		5.9	10.9	2.6	10.9	3.3	15.2	1.25	1.0	3.15	3.95
71E <sub>1</sub> 106		6.2	14.7	1.55	14.7	3.95	7.65	2.95	3.55	3.6	4.5
70E <sub>1</sub> 20		4.95	13.9	3.1	13.9	3.25	11.0	1.75	2.0	3.35	3.0
69E <sub>1</sub> 1		5.75	16	3.75	16	4	11	2.0	1.75	3.0	3.15
69E <sub>1</sub> 17		4.95	11.9	2.7	11.9	1.95	3.55	1.35	.95	2.5	3.6
69E <sub>1</sub> 9	18.6	6.3				3.25	10.3	1.7		3.95	
68E <sub>1</sub> 47		8.55	16.3	9.75	15.95	4.95	12	2.15	1.9	4.5	4.6
67E <sub>1</sub> 80	15.4	6.55	11.7	3.6	11.7	2.8	6.45	.6	.95	1.55	2.35
58E <sub>1</sub> 33		8.45				4.15	9		2.35		3.5
55E <sub>1</sub> 20		7.75	15.45	7.75	15.2	4.5	11.0	3.0	2.0	4.45	4.95
38E <sub>1</sub> 129	19.5	5.3	14.7	6.0	12.9	3.0	8.0	2.8	2.55	3.95	3.2
33E <sub>1</sub> 12		7.55	13.35	7.55	13.3	3.6	12.2	1.9	2.4	4.5	3.7
33E <sub>1</sub> 1	19.3	9.8	13.8	3.4	13.8	3.5	11.2	1.25	2.15	3.5	5.1
30E <sub>1</sub> 13	17.35	4.3				3.35	9.25	1.25		1.7	
19E <sub>2</sub> 15	22.5	6.45	12.4	2.65	12.4	3.4	8.75	1.4	.9	2.8	1.7
19E <sub>2</sub> 17		5.2	13.55	2.1	13.55	3.4	11.45	1.95	1.35	3.5	2.3
15E <sub>1</sub> 24		9	18.00	3.5	18.00	4.2	7.5	3.35	3.3	5.15	4.35

TABLE 2

LITHIC MATERIALS

LITHICS	LEVEL I				LEVEL II				LEVEL IIA			
	ARTIFACTS	FLAKES	TOTALS	%	ARTIFACTS	FLAKES	TOTALS	%	ARTIFACTS	FLAKES	TOTALS	%
CRYPTOCRYSTALLINES												
Black Cherts	18	20	38	9.3	27	5	32	10.3	4	2	6	26.1
Brown Cherts	5	7	12	2.9	11	18	29	9.4		1	1	4.3
Grey Cherts	10	14	24	5.9	5	14	19	6.1				
White Cherts	4	1	5	1.2		3	3	1.0				
Green Cherts					1		1	.3				
*Montana Chert	1		1	.2	3		3	1.0				
*Avon Chert					1		1	.3				
Pink Chert						4	4	1.3	1		1	4.3
*Brown Chalcedony	4	12	16	3.9	8	4	12	3.9				
White Chalcedony	2	1	3	.7	5	1	6	1.9				
Petrified Wood	17	46	63	15.4	12	54	66	21.3	1		1	4.3
Jasper	4	6	10	2.4	4	8	12	3.9				
TOTAL			145	35.4			188	60.6			9	39.1
QUARTZITE	48	191	239	58.3	47	51	98	31.6	2	7	9	39.1
QUARTZITE-CHERT?	1		1	.2								
TOTAL			240	58.5			98	31.6			9	39.1
OTHER MATERIALS												
Schist-like												
Material		7	7	1.7		11	11	3.5				
Sandstone, Lime-		18	18	4.4		13	13	4.2		5	5	21.7
stone, Dolo-												
mite, Granites												
TOTAL			25	6.1			24	7.7			5	21.7

\*Imported material

TABLE 3A IDENTIFIABLE BISON BONE: LEVEL I

BONE	COMPLETE	PROXIMAL END		DISTAL END		MINIMUM COUNT OF INDIVIDUALS
	RIGHT LEFT	RIGHT	LEFT	RIGHT	LEFT	
Cranium Fragments	Fragments					1
Maxilla	Fragments					2
Mandible		5		2		2
Hyoid	2					2
Atlas						
Axis	1					1
Cervical Vert.	5					2
Thoracic Vert.	8					2
Lumbar Vert.						
Os Inominatum	Fragment					1
Sacrum						
Caudal Vert.						
Scapula		1				1
Humerus				1		1
Radius		2				2
Ulna	2					2
Metacarpal	3		1		3	3
Femur						
Tibia				2	1	
Metatarsal	1	3		2		4
Patella						
Ribs	117 Frag.					
Carpals	16					
Tarsals	21					
Phalanges (1 & 2)	19					
Hoof Core	6					



TABLE 3B IDENTIFIABLE BISON BONE: LEVEL II

BONE	COMPLETE	PROXIMAL END		DISTAL END		MINIMUM COUNT OF INDIVIDUALS
	RIGHT LEFT	RIGHT	LEFT	RIGHT	LEFT	
Cranium Frag- ments	Fragments					7
Maxilla	Fragments					15
Mandible	2	50		27	7	29
Hyoid	26					26
Atlas	11					11
Axis	26					26
Cervical Vert.	63					
Thoracic Vert.	97					
Lumbar Vert.	6					
Os Inominatum	17 fr.					4
Sacrum	2 fr.					1
Caudal Vert.	37					
Scapula	20 16					20
Humerus	2	3	1	8	10	10
Radius	1	12	11	7	11	12
Ulna	10 13					13
Metacarpal	8 8	9	7	4	5	17
Femur					1	1
Tibia	1		2	11	8	11
Metatarsal	2	9	7	7	4	13
Patella	13					7
Ribs	674 fr.					
Carpal	118					
Tarsal	119					
Phalanges (1 & 2)	175					
Hoof Core	76					

TABLE 4A

## BONE TOOLS - DISTRIBUTION BY LEVEL

TOOL TYPE	POINTED TOOLS								BLADE TOOLS						
	I		IIA		IIB		IIC		III		IV		MISC.		
LEVEL	I	II	I	II	I	II	I	II	I	II	I	II	I	II	TOTALS
BONE															
RIB - PROXIMAL		1		1											2
MEDIAL		3	8	24	5	6	2	6		14	4	17		2	91
DISTAL															0
LONG BONE - SHAFT		3	1	9					12	3	10	5			43
END				12						5				1	18
SCAPULA				1		1				3					5
MANDIBLE				4											4
		7	9	51	5	7	2	6	12	25	14	22		3	163

Note: 20 unassociated bone tools have been excluded from this table.

TABLE 4B

## BONE TOOLS - WORKING EDGE

WORKING EDGE																															
	HANDLE				TYPE OF EDGE								LOCATION						PREPARATION				WEAR		LENGTH						
	END				Proximal	Distal	Medial	Frag. of Medial	Pointed	Rounded	Edged on End	Edged on Side	Smoothed Surface	Roughened End		Anterior	Posterior	Lateral	Medial	Dorsal	Ventral	Unident	Whole End Surp.	Original Break	Grinding	Percussion	Deliberate Shaping	Parallel to Long Axis	Angle to Long Axis	Less than 15 cm	Greater than 15 cm
Rib		6		97					62	25	14		1	1		24	5		33			6	1	77	22	4	9	100	3	65	38
Metapodial		2	1						3							2			1					2		1			3		
Tibia			2	1					2					1				1	1				1	2		1			3		
Femur																															
Humerus			5						1		4					2	2		1					1		4		5			
Radius		4	3						7							1	2	2	4					5	2			7			
Ulna		2							1		1						2								1			2			
Scapula		1		4	1	2	2	1									4		1			1						6		2	4
Mandible		1	1	2		4											2				2			4							
Long Bone Frag.				50	16	17	17																	36	4	10				46	4

TABLE 5

SCHEMATIC DIAGRAM OF THE LATE PREHISTORIC PHASES

YEAR		KEHOE	REEVES	BYRNE	ADAMS
B.C.	1500	Hanna Phase	Hanna Phase	Hanna Phase	Hanna Phase
	1000		Pelican Lake Phase	Pelican Lake Phase	Pelican Lake Phase
	500	Pelican Lake Phase			
A.D.	0	Besant Phase			
		Avonlea Phase	Avonlea Phase	Avonlea Phase	Avonlea Phase
	500	Samantha Phase	Besant Phase	Besant Phase	Besant Phase
		Prairie Side-notched Phase	Old Women's Phase	Old Women's Phase	Old Women's Phase
	1000	Plains Side-notched Phase			
	1500	C E R A M I C S			
			One Gun Phase	One Gun Phase	One Gun Phase
	2000	Historic	Historic	Historic	Historic





Figure 9: Aerial View of Estuary Site Coulee System



Figure 10: Site as seen from South





Figure 11: Site as seen from North



Figure 12: Coulee as seen from Site, Looking North toward South Saskatchewan River



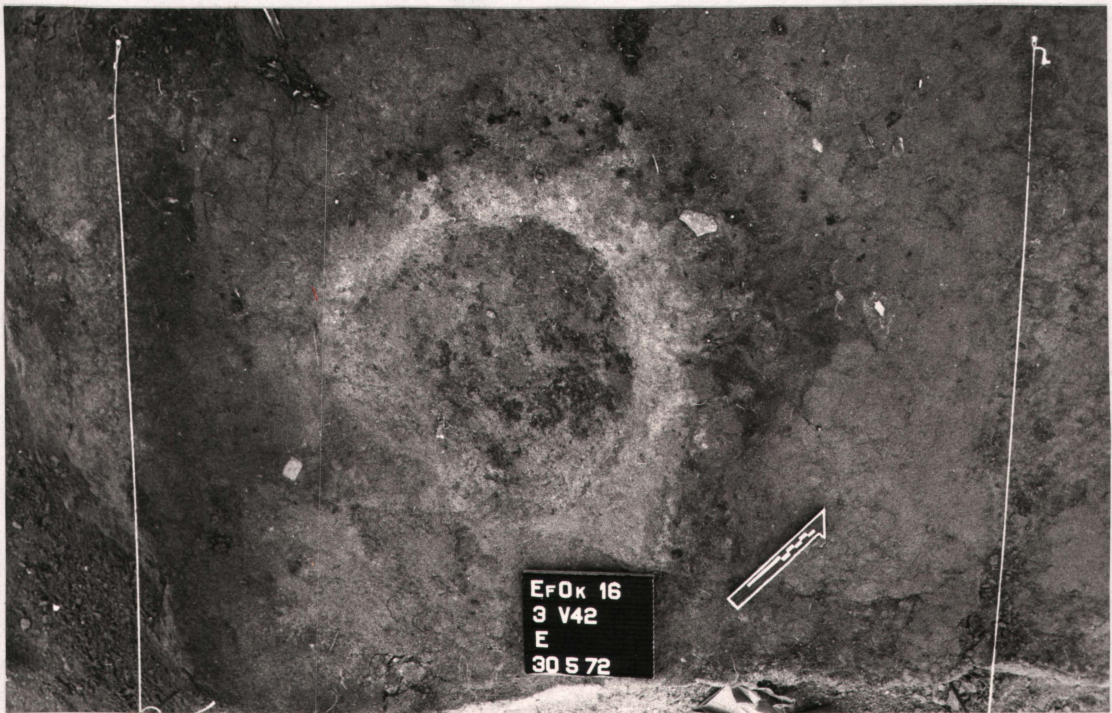
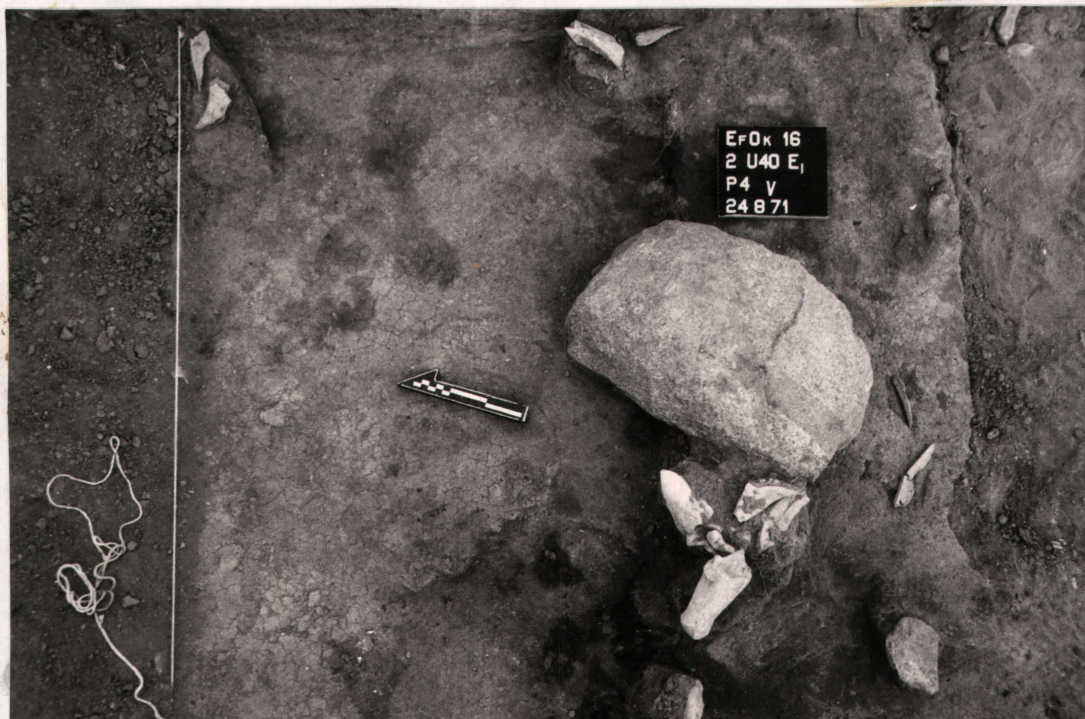


Figure 13: Hearth H-4



Figure 14: Closeup of depressions around rim of Hearth H-4





EFOK 16  
2 U40 E<sub>1</sub>  
P4 V  
24871

Figure 15: Large rock  
and portion of Hearth  
H-10



Figure 16: Profile of  
posthole P-16





Figure 17: Portion of Level II bone bed

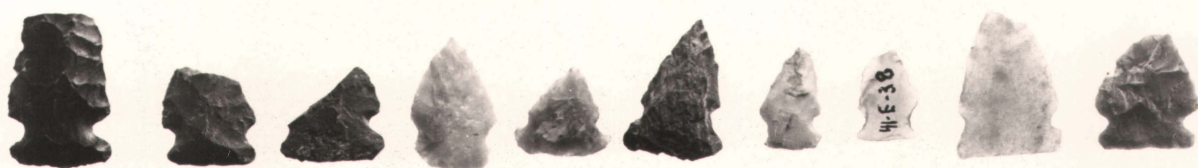


Figure 18

Type I (Prairie Side-notched Projectile Points)

a-aa: Level I  
bb-ww: Level II

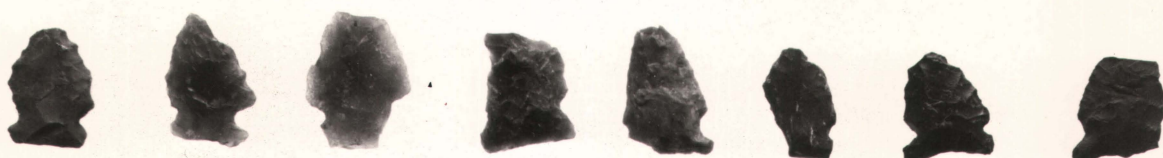




a b c d e f g h i



k l m n o p q r s



t u v w x y z aa



bb cc dd ee ff gg hh ii



jj kk ll mm nn oo pp



rr ss tt uu vv ww

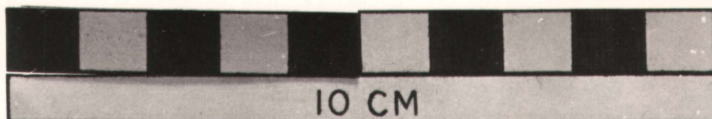




Figure 19

Projectile Points

a-u: Type I (Prairie Side-notched) projectile points, unassigned level  
v : Type II projectile points, Level I  
w, x: Type II projectile points, Level II  
y : Type IV projectile points, Level I  
z : Type V projectile point, unassigned level





a



b



c



d



e



f



g



h



i



j



k



l



m



n



o



p



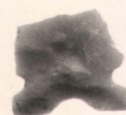
q



r



s



t



u



v



w



x



y



z

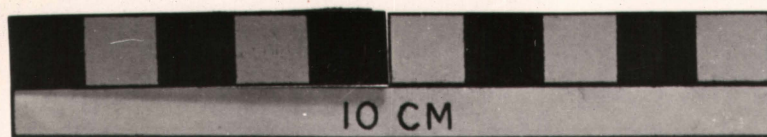




Figure 20

Type III (Avonlea) Projectile Points

a-ee: Level II  
ff-11: Unassigned level



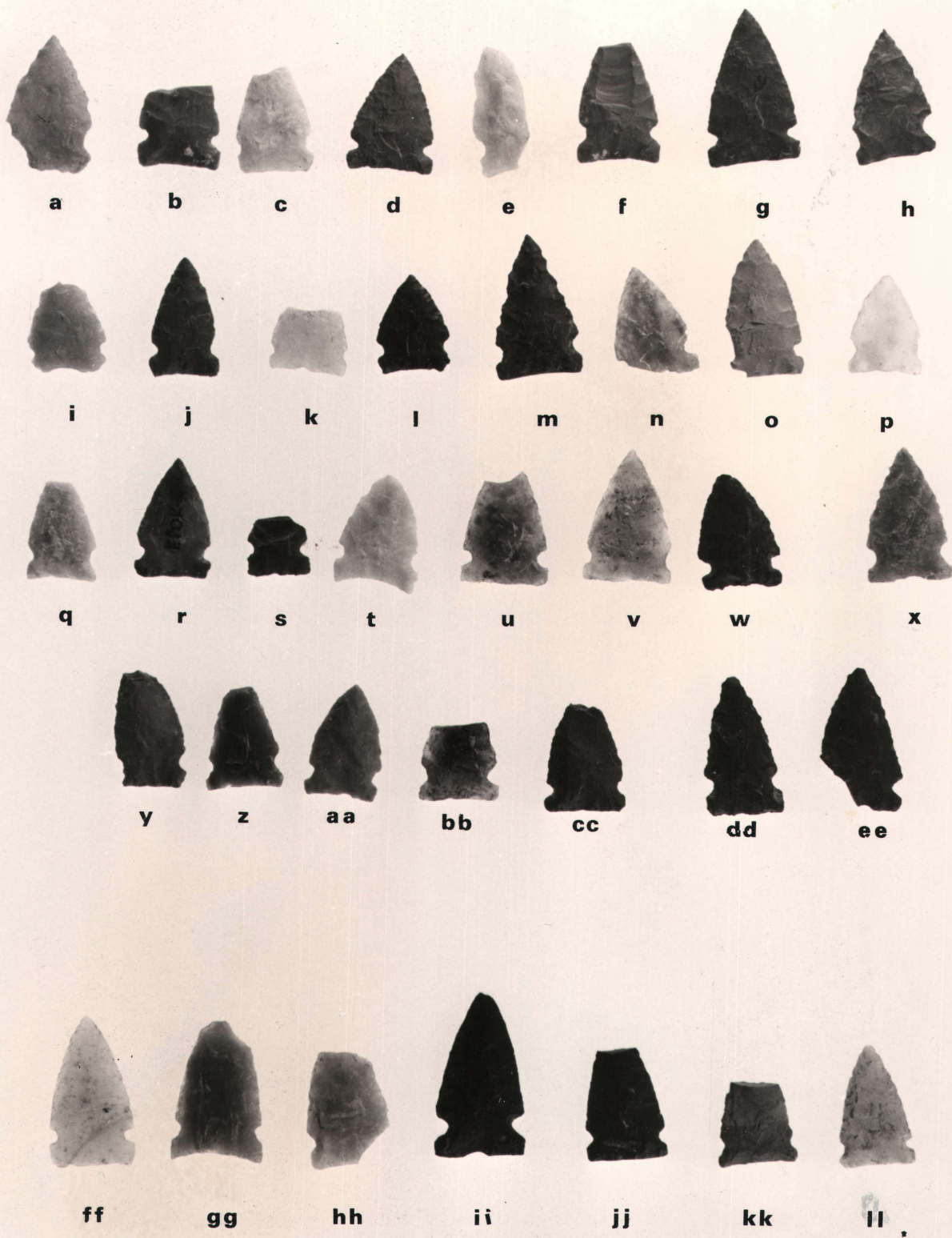




Figure 21

Bifaces

a-c: Type I; Level I  
d, e: Type I; Level II  
f: Type II; Level I  
g: Type III; Level I  
h: Type V; Level I  
i-m: Type IV; Level I  
n-p: Type VI; Level I  
q, r: Type VI; Level II  
s-u: Type VI; unassigned





**a**



**b**



**c**



**d**



**e**



**f**



**g**



**h**



**i**



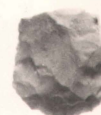
**j**



**k**



**l**



**m**



**n**



**o**



**p**



**q**



**r**



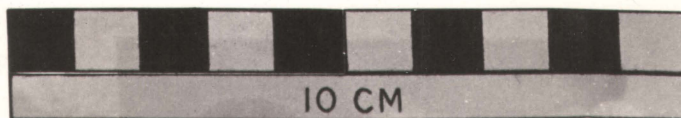
**s**



**t**



**u**



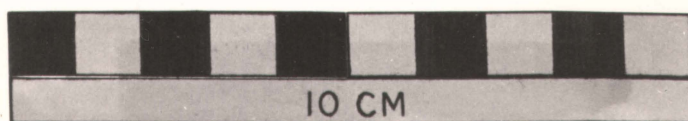




Figure 23

Endscrapers

a-f: Type I; Level I  
g-o: Type I; Level II  
p: Type II; Level I  
q: Type III; unassigned



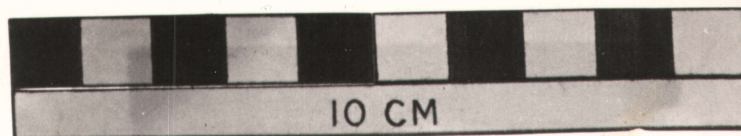
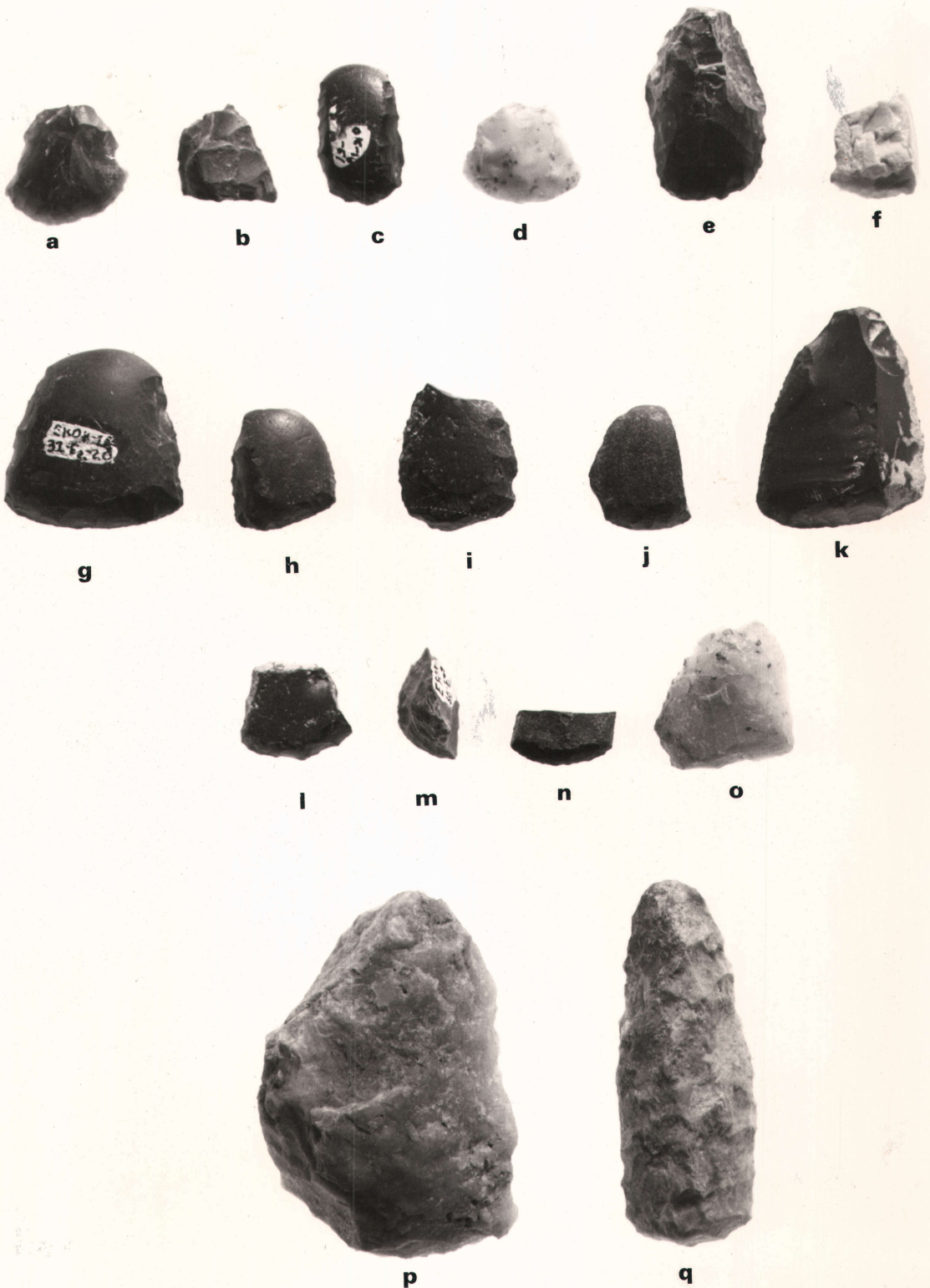




Figure 24

Sidescrapers and Unifaces

a-f: Type I; Level I  
g-m: Type I; Level II  
n-p: Type II; Level I  
q-u: Type II; Level II  
v-y: Type IV; Level II





a



b



c



d



e



f



g



h



i



j



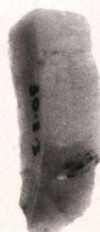
k



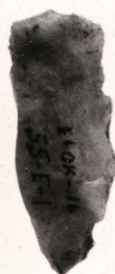
l



m



n



o



p



q



r



s



t



u



v



w



x



y

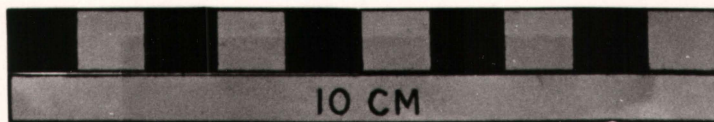




Figure 25

Large Unifaces

- a: Type IV; Level II
- b-d: Type V; Level II





a



b



c



d

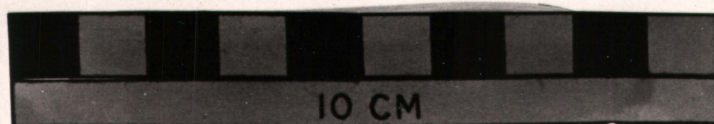




Figure 26

Pièce Esquillées and Ceramics

- a-d: Piece Esquillees from Level I
- e: Piece Esquillees from Level II
- f, g: Ceramic fragments from Level II
- h-j: Ceramic fragments, unassigned





a



b



c



d



e



f



g



h



i



j

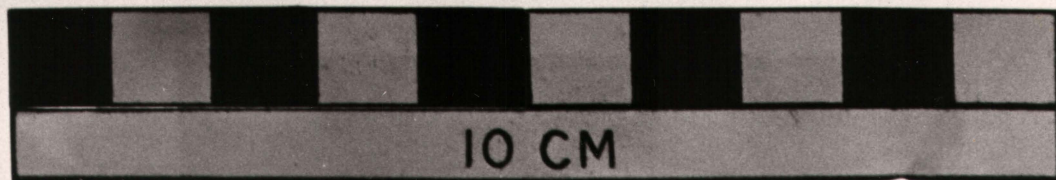




Figure 27

Cobble Tools

a: Level II  
b-c: Unassigned



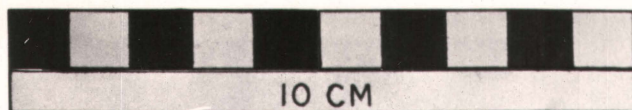
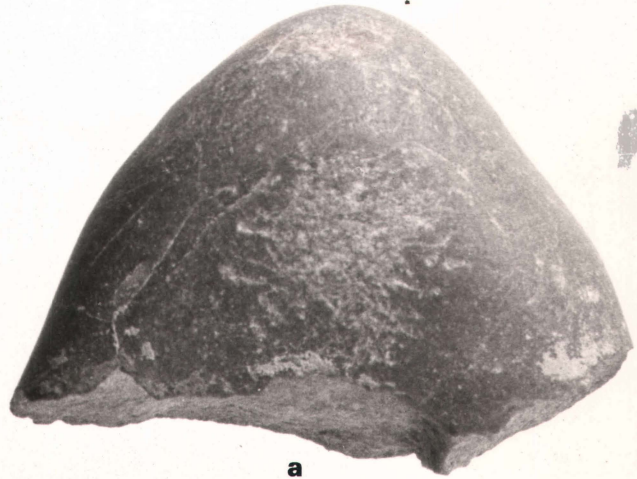




Figure 28

Bone Tools, Type I

Plate, Type







Figure 29

Bone Tools, Type IIA



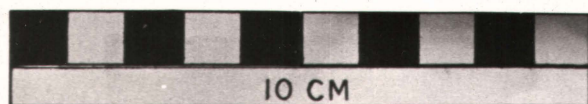




Figure 30  
Bone Tools, Type IIA







Figure 31

Bone Tools, Types IIB and IIC



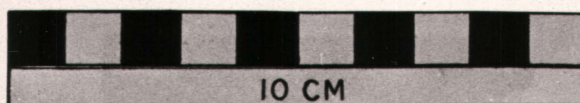




Figure 32  
Bone Tools, Type III







Figure 33

Bone Tools, Type III



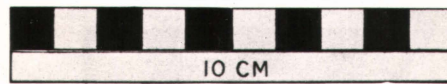




Figure 34  
Bone Tools, Type IV



